ARMED ESCORT FOR SPECIAL AIR OPERATIONS-- AN OPERATIONAL CONCEPT

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

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This study hypothesizes that armed escort is required to protect special operations lift helicopters inserting, extracting, or resupplying SOF ground teams deep in the enemy rear. It compares the escort doctrine and tactics utilized by conventional air assets with current special operations tactics in light of the proliferation of highly capable air defenses among lesser developed nations.

Beginning with the historical perspective of armed escort, then examining the current and projected threat, this study concludes that armed escort is indeed required to counter the increasingly capable and proliferating air defense threat. Based upon Phase One of the Concept Based Requirements System, Concept Formulation, this thesis proposes an Operational Concept for armed escort.

The doctrine and tactics for armed escort during deep assault and attack missions already exist in Army and Air Force manuals. In order to conduct long-range clandestine penetrations, conventional doctrine needs modification. Part of the adjustment has to be in mindset--forcible entry is the least preferred option in most Direct Action or Special Reconnaissance scenarios.

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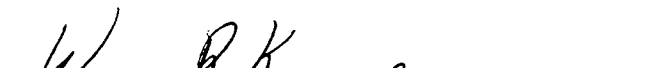
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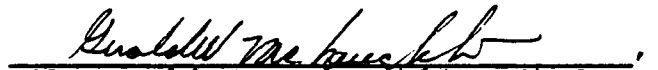
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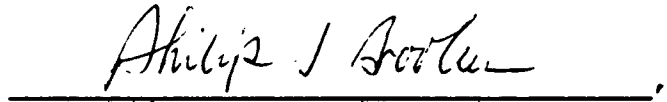
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ABSTRACT

ARMED ESCORT FOR SPECIAL AIR OPERATIONS--AN OPERATIONAL CONCEPT. by Major Richard D. Newton, USAF, 151 pages.

This study hypothesizes that armed escort is required to protect special operations lift helicopters inserting, extracting, or resupplying SOF ground teams deep in the enemy rear. It compares the escort doctrine and tactics utilized by conventional air assets with current special operations tactics in light of the rapidly increasing threat among lesser developed nations.

This study is based upon a Soviet-style, Third World threat. As the Soviet Union continues to modernize and field new air defense systems and interceptor aircraft, much of the older and some modern equipment is sold or given to allies, clients, and surrogates. The proliferation of highly capable weapons among developing nations has improved their air defenses and significantly complicated the problem of special air operations attempting clandestine penetrations.

Beginning with the historical perspective of armed escort, then examining the current and projected threat, this study concludes that armed escort is indeed required to counter the increasingly capable and proliferating air defense threat. Based upon Phase One of the Concept Based Requirements System, Concept Formulation, this thesis proposes an Operational Concept for armed escort.

The doctrine and tactics for armed escort during deep air assault and deep attack missions already exist in Army and Air Force doctrinal and tactics manuals. Conventional doctrine needs modification, though, to meet the unique requirements of clandestine penetrations 200 or more miles in depth. Part of the adjustment has to be in mindset--forcible entry is the least preferred option in most special operations Direct Action or Special Reconnaissance scenarios.

Many questions and issues raised by this study warrant further attention. Among these are electronic combat implications, appropriate mix of weapons, and training issues. The intent of this thesis, however, was to propose the initial Operational Concept within allowable classification limits and stimulate future quantitative and qualitative studies.

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CHAPTER I

INTRODUCTION

A. Thesis Question: How should special operations force (SOF) helicopters be protected while supporting long-range (greater than 200 nm radius) Direct Action or Special Reconnaissance missions? This study will address protection and security of SOF helicopters facing air-to-air and ground-based air defenses in the unique operating environment of special air operations.

B. Purpose: The purpose of this study will be to propose a Operational Concept within the context of the Concept Based Requirements System (CBRS). The CBRS three phase process begins with the Concept. This eventually leads into the Life Cycle Management System which integrates Service planning and programming for future equipment, doctrine, force structure, and training.[1] This thesis will initiate Phase One of the CBRS process, Concept Formulation.

C. Importance of the Study: This thesis is based upon the premise that the proliferation of highly capable air and ground-based air defense systems throughout the world

makes Special Operations helicopters conducting clandestine pentrations deep into hostile or denied areas extremely vulnerable. An additional premise is that the requirement for Special Operations forces capable of conducting these missions will continue to increase as low-intensity conflict correspondingly grows as the most likely form of military confrontation the United States will face.[2]

D. Background: The threat to Special Operations helicopters has changed in the last five years. It has become more sophisticated and has expanded beyond the Western, developed nations. As the arms producers and superpowers develop and improve air defense systems, they sell older, or sometimes state-of-the-art, systems on the world arms market. Because of this, Third World nations are improving their capability to detect, track, and target SOF helicopters penetrating their airspace. Their improved capability is degrading US ability to maintain offensive surprise, initiative, and flexibility during special air missions.

For over 40 years, the United States focused its attention on high-intensity conflict in Europe. For special operations aviation, that meant excess capability to penetrate hostile and denied airspace in many regions of the world. The proliferation of highly capable air defenses among developing nations has decreased or eliminated any technological

advantage SOF helicopters may have held in many scenarios.

> When conducting deep penetrations special operations helicopters are exposed to a variety of threats such as acquisition and targeting devices, air defense missiles and guns, and fixed and rotary-winged interceptor aircraft. Special operations airlift assets require the protection of attack aircraft . . . .[3]

The air defense threat to special operations helicopters has typically been limited to day-only operations. Improved tactical surface-to-air missile systems, the emergence of the fighter-helicopter, and the proliferation of look-down, shoot-down radar systems on threat interceptor airplanes have expanded the nature of the threat. It is expected that air defenses and early warning systems would operate around the clock. Improvements in enemy night vision imaging and electronic detection systems are diminishing the protection afforded by night and low-level operations--the tactical refuge for special operations aviation. Because success is usually defined as infiltrating and departing the objective area without the enemy knowing friendly forces were present, enhanced enemy detection and targeting capability makes it more difficult to successfully execute a mission. The tactical advantage of night, low-level operations is rapidly diminishing.

Until recently, preoccupation with the most dangerous threat to US national survival, nuclear or conventional war between the superpowers, caused Special Operations to be a

tertiary mission for the Services. The air support forces assigned to it were not afforded the amount of resources that allowed other mission areas to develop forcible entry tactics. More importantly, though, the secretive nature of their operations often made it unwise to acknowledge the presence of the ground teams or aircraft performing the mission. Forcible entry was usually the least preferred method, whether resources to do so were available or not. This nearly absolute requirement for secrecy also kept the number of aircraft involved in a mission to a minimum and their capability very specialized--airlift by unconventional means. As the emphasis shifts slightly away from major conventional or nuclear war, there is new recognition as to the necessity for more and better capable special operations aviation and ground forces.[4]

SOF helicopters have been able to rely on terrain masking and night operations to avoid detection. These tactics have been the key to helicopter survivability in most air defense environments. Current lift helicopters are equipped with terrain following radar, self-protection electronic warfare avionics, and other radar, laser, and infrared detection defeating systems. While these don't guarantee survivability should the lift helicopters have to face fighter-helicopters, modern fighters, or ground-based air defenses, they do improve the odds by making detection more

difficult. If the enemy cannot find the helicopters, they also cannot shoot them down.

Special operations lift helicopters are large, heavy, and not very agile. Their performance is limited primarily by their physical characteristics (size, speed, rotor dynamics) and further by their extremely low-altitude operating environment and the need to perform their missions at night. When compared to threat air defenses the lift helicopters are at a distinct disadvantage, even with onboard protective machine guns. Operational experience in Southeast Asia taught that "the insert helicopter never flies tactical missions without an escort."[5]

The need for armed protection seems to go beyond the capability of the onboard systems currently installed. These organic weapons are, for the most part, area suppression weapons, not intended for air-to-air combat nor suppression of enemy air defenses (SEAD). If a formation is compromised, it is likely that the mission would be cancelled. Should that occur, the primary concern becomes returning the aircraft and ground teams safely to home station. Depending upon the threat, simple disengagement may not be possible. The formation might have to fight to disengage from the threat.

Protective fighters on-call are a possible counter to enemy interceptors, but response time makes it nearly impossible for them to assist with the immediate threat.

This study supposes that the principles which govern the security of conventional air assets applies as well to special operations helicopters. Escort doctrine, tactics, and procedures already exists for deep strike air assaults. With modifications to training, mindset, and equipment, the same doctrine should apply in the unique environment of special air operations.

D. Assumptions:

(1) The Army and the Air Force will continue to focus the bulk of their doctrinal and procurement efforts on strategic missions.

(2) As the Services reorient their conventional forces away from the Soviet Union and a World War III scenario, Special Operations Forces will receive more resources, responsibility, and taskings.

(3) The size of aircraft formations engaged in special air missions will remain small, generally less than

four lift helicopters, in order to minimize the possiblity of detection and compromise and maximize operational security.

(4) Electronic combat, including both active and passive countermeasures, will be required to survive on the future battlefield.

(5) Any air defense systems or interceptors sold to Third World nations will be employed competently, although there will be exploitable weaknesses due to training, employment, or force structure.

(6) New aircraft design and procurement is an unlikely and unacceptable short term or interim solution for the US military. Decreasing budgets and declining force structure militate against this option. Any equipment solution found necessary would likely be limited to modifying existing airframes to perform the mission in the near term.

E. LIMITATIONS: This thesis is constrained in the following ways:

(1) Only the special operations helicopter mission is studied. In order to limit the scope of this thesis, the fixed wing special operations mission was not addressed.

(2) Only actions by US forces are considered. There are many scenarios in which it would be necessary or at least desirable to have host nation forces conduct the mission. This thesis did not address those instances.

(3) Within the Special Operations Mission Areas defined by FM 100-20 and AFM 2-20, only Direct Action and Special Reconnaissance are considered. Unconventional Warfare (UW), Foreign Internal Defense (FID), and Counterterrorism (CT) while important, are unique in their special aviation requirements. UW and FID are based upon host nation forces supporting themselves. The most likely role for United States forces would be as advisors or trainers, although there are exceptions. CT, on the other hand, is usually performed by specially trained, equipped, and employed units. Except for providing supporting forces or conducting CT training in conjuction with a FID mission, it is unlikely that most SOF units would participate in Counterterrorism.

(4) The special operations close air support mission is considered a Direct Action type of mission, but for the purpose of this paper, it was not considered. This study concentrates on clandestine entry and departure, in the context of inserting, extracting, or resupplying a SOF ground team. While SOF fire support aircraft utilize the same tactics and procedures for penetrating hostile or denied

airspace, once they begin to place fire onto a target they are no longer clandestine. The focus of this paper was protection of SOF helicopters after discovery and compromise of a clandestine mission.

(5) Much of the technical information concerning special operations tactics and organization since Vietnam is classified. This is especially true if actual units and locations are mentioned. Most after-action reports and studies remain classified for this same reason. Credible open sources were used when possible and capabilities and tactics are discussed in general, unclassified terms. This reliance on open source literature was done to allow widest possible dissemination of this study.

(6) Likewise, most threat capability information is also classified. Furthermore, discussions of this nature about actual countries tend to be politically sensitive. Unclassified data is reasonably close enough for the purposes of this study.

F. DELIMITATION: Under the Concept Based Requirement System, Phase One is Concept Formulation.[6] Based upon history, doctrine, technology, threat, and friendly capabilities, a Concept is developed. The branches, contractors, integrating centers, or weapons system experts

further refine the Concept to develop a quantitative Systems Concept. The Systems Concept is a subsequent result of Phase One. Based upon the CBRS, this thesis will propose a Concept. Step Two, Identify and Prioritize Needs, and Step Three, Identify and Prioritize Solutions, are left for further study.

[1]TRADOC Regulation 11-15, Concept Based Requirements System (Ft Monroe, VA: Hq US Army Training and Doctrine Command, June 1989), p 3.

[2]Caleb Baker, "Interview with General James Lindsay, Commander-in-Chief, US Special Operations Command," Defense News, Vol 5, No 16 (16 April 1990), p 30.

[3]US Army Interim Operational Concept for Special Operations Aviation (Ft Bragg, NC: US Army John F. Kennedy Special Warfare Center and School, 1989), p 16.

[4]The 23 April 1990 edition of Defense News reported that the Army Modernization Plan was reorienting away from the Soviet Union and the Warsaw Pact towards the more likely conflicts in the Middle East, South America, and Africa.

[5]Lessons Learned No 83, Guide for Helicopter Tactics and Techniques for use with Reconnaissance Teams (US Army Military Assistance Command, Vietnam), p 23.

[6]TRADOC Regulation 11-15, p 5.

CHAPTER II

REVIEW OF THE LITERATURE

There is extensive material available to support this thesis and the studies that might follow. Because the goal of this paper was to Formulate a Concept, the concentration is on the historical perspective and an unclassified discussion of the present doctrine, the impact of technology, current and evolving threats, and current capability. History cannot prove nor disprove a concept, but it does serve as a starting point. From there, with a common frame of reference, one can critically examine doctrine and capabiltiy in light of current and developing threats. This leads to the development of a Concept.

Background

Special Operations are those actions conducted by specially organized, trained, and equipped land, sea, and air forces to achieve military, political, psychological, or economic objectives by nonconventional military means. Special operations differ from conventional military operations in degree of risk, operational techniques, mode of employment, independence from friendly support, and

dependence on indigenous assets.[1] In many cases, they involve high risk and potential embarrassment for the United States. On the other hand, successful special operations result in extremely high payoffs at relatively little cost. Special Operations can occur across the entire spectrum of conflict, but are most appropriate for the LIC missions of Peacetime Contingency Operations, Insurgency/ Counterinsurgency, and Combatting Terrorism.[2]

The unique nature of low-intensity conflict requires a multidimensional response. (See Fig 2-1.) The definition currently accepted by military writers is found in the latest draft of the joint Army-Air Force regulation, FM 100-20/AFM 2-20, Military Operations in Low-Intensity Conflict. In this publication, LIC is described as "a politico-military confrontation between contending states or groups below conventional war and above the routine, peaceful competition among states."[3]

The military element of national power is only one of a range of options available to conduct politico-military confrontations in that amorphous area between war and peace. The military forces employed are rarely large, "heavy," and conventional, although they might be. Rather, the forces employed would be tailored to the mission at hand. Each situation is different and the corresponding response is

likewise situationally unique. There is no "textbook" solution.

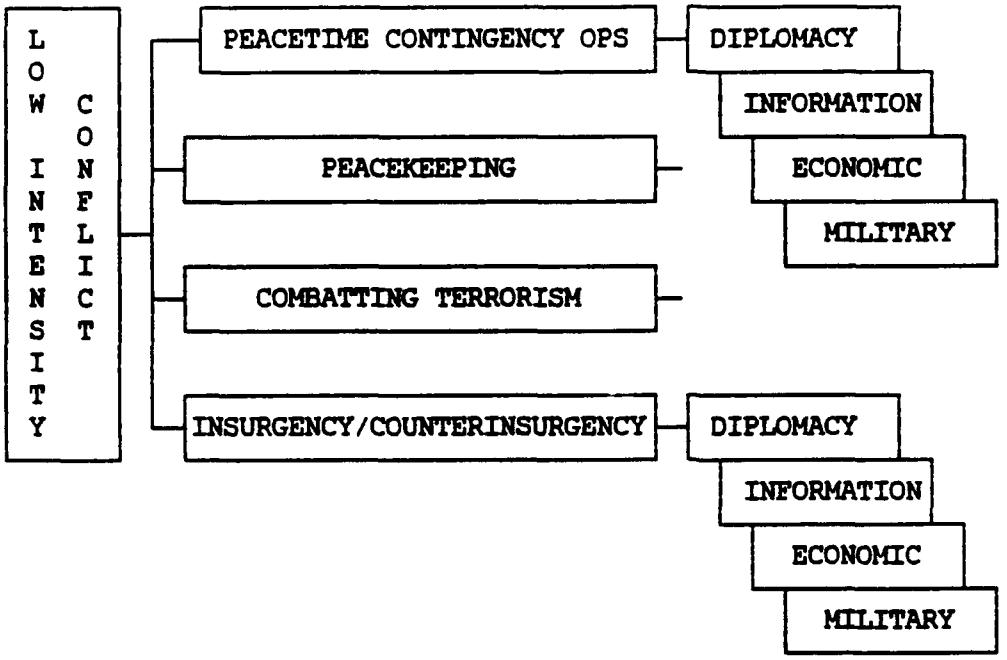


Fig 2-1.

Special Operations Forces (SOF) are not a substitute for conventional forces, but a unique capability in their own right. Although they are a necessary adjunct to existing conventional forces, SOF are designed for specific principal missions.[4] In addition, special operations are predominantly joint in nature. This traditional bond between the Service special operations components goes all the way back to the beginnings of SOF aviation.[5] Because there are few overlaps in capability, the Service special operations aviation elements are forced to rely on each other to get the

job done. It also requires that the services integrate their operational concepts. This offers planners and commanders a wide range of options and unprecedented flexibility.

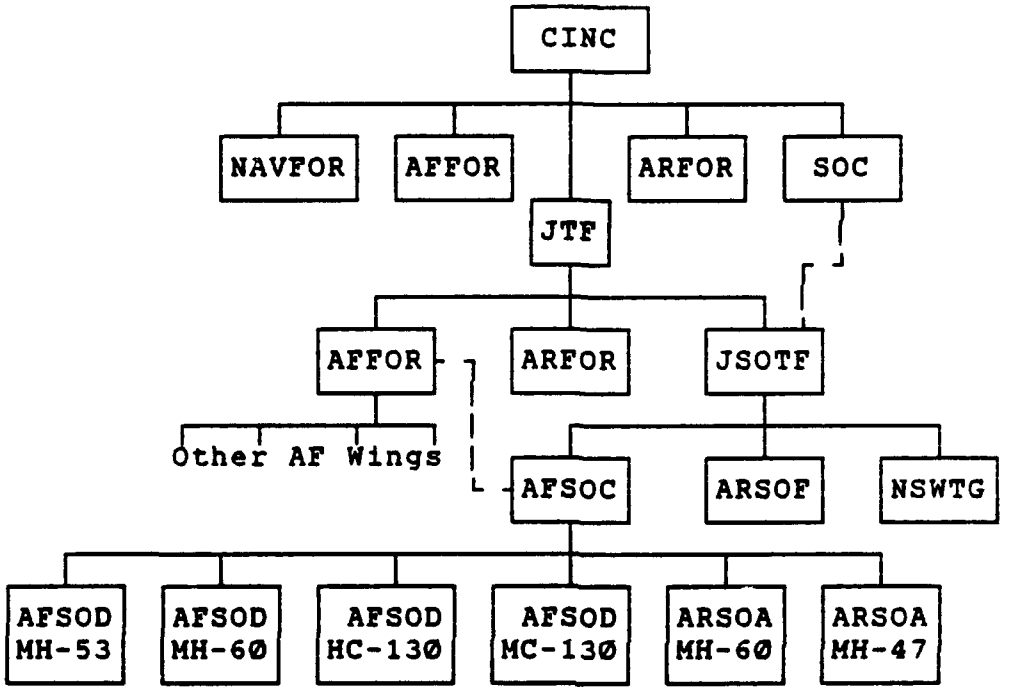


Fig 2-2.[6]

Joint and Service directives break special operations into five principal, interrelated mission areas: Direct Action, Unconventional Warfare, Special Reconnaissance, Foreign Internal Defense, and Counterterrorism.[7] Aviation units assigned to SOF provide unique air support capability to each of the five special operations missions. SOF aviation is usually task organized across Service lines to provide flexibility and the most responsive force possible to the

joint task force commander. (See Fig 2-2.) An Army or an Air Force commander could serve as the air component commander of the Joint Special Operations Task Force, depending upon the number of resources committed to the mission. In addition, virtually all conventional air assets have the potential to conduct or support special operations.[8] Except for units specifically trained for special operations, however, other aviation forces are mostly limited to a narrow range of contingency operations (e.g., F-111s attacking Libya) or support functions (e.g., inflight refueling by KC-135s).

Special air operations by the United States trace back to the 1st Air Commando Group in Burma during World War II. This unique organization was the individual inspiration of General Henry H. "Hap" Arnold.[9] He allocated a force of transports, liaison airplanes, light bombers, fighters, gliders, and helicopters to the exclusive support of the British Special Forces fighting the Japanese in the jungles of Burma. This composite air force cut across traditional organizational lines, infusing it with a sense of uniqueness and independence.[10] By developing or expanding the use of new equipment, helicopters, air-to-ground radios, and airdrop systems, the 1st Air Commando Group established the tradition of innovation, independence, and commitment that has come to characterize special operations aviation.

In 1961, the Air Force activated the 4400th Combat Crew Training Squadron to train foreign aircrews and ground crews to fly and maintain attack, reconnaissance, and airlift airplanes. In 1962, responding to pressure from President Kennedy to fight "Communist-sponsored wars of national liberation," the 4400th was absorbed into the Special Air Warfare Center. Within the Center, the responsibility for training allied crew in counterinsurgency techniques fell to the reactivated 1st Air Commando Group.[11]

As the war in Southeast Asia continued and the requirement for counterinsurgency air strikes and airlift increased, the role of the Center changed from training allied crews to providing US crews for the war effort. Reflecting the increasing American commitment and the spiralling number of US ground troops, by late 1966 the air commandos were flying mostly in support of US activities. In 1974, with the withdrawal of US forces from Southeast Asia, the Special Air Warfare Center (since renamed the USAF Special Operations Force) was inactivated.[12] For almost the nex: ten years, special operations in the Air Force was neglected and underfunded.[13] It took Congressional pressure after the embarassment at Desert One to force the Air Force to adequately man and fund its special operations force.

Today, the Air Force Special Operations Command claims status as a subordinate numbered air force under Military Airlift Command and as the air component of US Special Operations Command. Its three operational wings have been resourced, funded, and located in their respective theaters; Europe, Pacific, and in the continental United States. The Army has also reorganized its special operations aviation, forming a regiment with headquarters collocated with Army Special Operations Command. Both Service components are receiving new equipment and enjoy renewed emphasis and priority.

Concept Development System

One of the biggest stumbling blocks to successful completion of this thesis was finding an appropriate methodology to employ. TRADOC Regulation 11-15, Concept Based Requirements System (CBRS), provided that methodology. The TRADOC Analysis Command also provided a briefing and paper copies of briefing slides to help explain the CBRS.

Prior to the its adoption of the Concept Based Requirements System, there was no formal process by which the Army linked its doctrine, organization, training, tactics, and equipment. Too often, the process was driven by contractors developing new hardware and the Army deciding how best to employ and manage the weapon systems after their procurement.

Furthermore, there was little integration between the branches or the different Services.

In the early 1980s, the Army realized that it had to devise a better way of managing its limited research, development, and acquisition dollars. The high cost of weapon systems meant the Army could not afford to buy something which generated more problems than it solved. In 1984, the Concept Based Requirements System was born as the first step to a rational procurement process. It allowed proponents in the various sectors of the Army and in the different Services to formally approve an idea before submitting it to industry. The goal of CBRS was to evaluate technology based upon identified deficiencies within functional mission areas, rather than changing missions and organizations after the new technology was placed into the inventory.

Under CBRS, proponents identify warfighting needs within their functional mission areas. Based upon the current and evolving threat they note deficiencies in US capability, suggest opportunities to take advantage of emerging technology, and track the service life of current weapon systems to anticipate fleet obsolescence and necessary modernization programs. Warfighting needs translate into a Concept, initiating the CBRS process.

The Concept Based Requirement System was the basis for this thesis. Because the anticipated outcome of the study is to eventually change doctrine and tactics, as well as influence aircraft modification, it was necessary to remain within a format accepted and understood by the Services' combat developers, force structure planners, and weapon system experts. Alternatives to CBRS were not considered because it was felt that the best way to effect changes would be to work with a methodology recognized and approved by the Services.

Annotated Bibliography

Historical Perspective

The Army's and the Air Force's experiences protecting helicopters, transports, and bombers from state-of-the-art defenses has revealed some important lessons that bear consideration. They graphically illustrate the cyclical nature of technological and tactical advantage, and how this affects the balance between offense and defense. In each of the major conflicts examined, World War II, Korea, and Vietnam, the technological or weapons system advantage initially enjoyed by the offense was denied or significantly diminished by air defense advances, then countered and at least partially restored by changing offensive tactics.

Although scattered throughout many volumes, there is sufficient material to discern the historical perspective behind armed escort in a conventional sense. The Army Air Forces in World War II, Vol III: Europe: Argument to V-E Day, Jan 44 - May 45, edited by W.F. Craven and S. L. Cate, and The Development of Air Doctrine in the Army Air Arm, 1917-1941, by Thomas Greer, contain excellent accounts of the development and problems of escort aviation prior to and during World War II as essential parts of their general histories of strategic bombardment. General Haywood Hansell's memoir, The Strategic Air War Against Germany and Japan, and James Parton's biography of General Ira Eaker, Air Force Spoken Here were personalized accounts on the development of fighter escort, again as part of the much larger story of WW II.

Dr Robert F. Futrell has done the best work concerning the air campaigns in Korea. His book, The United States Air Force in Korea, 1950-1953 provides valuable insights, showing how doctrine was modified in the face of rapidly changing weapons technology, and vice versa. General William W. Momyer's book, Airpower in Three Wars, was another outstanding source and helped make the transition from World War II, to Korea, and into the Vietnam conflict.

When it came to looking at Southeast Asia, the most valuable records dealing with special air operations during this period are still classified. The CHECO reports and many of the operational reports of the Air Commandos should be declassified in the near future, but were unavailable for this paper. Because the thesis was looking at armed escort of helicopters, Search and Rescue in Southeast Asia, 1961-1975 proved to be the best unclassified source. It gave excellent descriptions and analysis of combat rescue forces overcoming the sophisticated air defenses of North Vietnam, as well as some background into the problems faced by Army helicopters flying in South Vietnam. Discussions with veterans of the Vietnam combat rescue efforts were an inspiration for this thesis. Lt Col Gary Weikel, a pilot during the rescue of the crew of the Mayaguez, provided his perceptions of this Direct Action mission. Benjamin F. Schemmer's book about the mission to rescue the prisoners-of-war at Son Tay, The Raid, gives a good description of typical tactics used by special operations helicopters to avoid detection during long range penetration for a Direct Action Mission.

Threat

Kenneth P. Werrell's book, Archie, Flak, AAA, and SAM: A Short Operational History of Ground-based Air Defense, provides a discussion on the development and use of

air defense systems from WW I through the Arab-Israeli and Falklands conflicts. His book covers the ebb and flow of weapons system advantage from the offense to the defense in each major conflict. It also looks at air defenses in various settings, from the high intensity battles of World War II and Korea, to the low intensity environments of South Vietnam and the Falklands. This book presents an excellent overview and some valuable insights to an oft neglected subject.

The US Army produces a superb three volume series of field manuals, FM 100-2-1 through FM 100-2-3, entitled The Soviet Army. The stated intention of these manuals is to serve as "the definitive source of unclassified information on Soviet ground forces and their interaction with other services in combined arms warfare." Volume 1, Operations and Tactics, and Volume 3, Troops, Organization, and Equipment, were the most useful to this thesis. They provided the credible open source documentation needed to conduct this study. In addition, the Threat chapter in FM 44-100, US Army Air Defense Operations, helped understand Soviet air defense doctrine and its application among Soviet client states and surrogates.

The preeminent source of unclassified weapons system data is the Jane's series. Two volumes, Land-Based Air

Defence and All the World's Aircraft were used to build the charts in Chapter V, comparing threat and friendly systems. Complementing the Jane's volumes is the "Soviet Aerospace Almanac" published each year by the Air Force Association. Although much of it is taken from Jane's, the analysis portion was helpful in showing trends and proposing future possibilities.

Current Doctrine

Special Operations are those actions conducted by specially organized, trained, and equipped land, sea, and air forces to achieve military, political, psychological, or economic objectives by nonconventional military means. They can occur across the entire spectrum of conflict. They differ from conventional operations in degree of risk, operational techniques, mode of employment, independence from friendly support, and dependence on indigenous assets.

Recognizing that special operations are predominantly joint in nature, JCS Publication 3-05, Doctrine for Joint Special Operations, FM 31-20, Doctrine for Special Forces Operations, FM 100-25, Doctrine for Army Special Operations Forces (Coordinating Draft), Chapter 9, and the initial draft of the revised AFM 2-10, Aerospace Operational Doctrine for Special Operations are the doctrinal manuals pertaining to special operations aviation.

Within the realm of conventional aviation roles, FM 1-100, Army Aviation in Combat Operations, FM 1-112, Attack Helicopter Battalion, and FM 1-113, Assault Helicopter Battalion, are excellent sources concerning the protection and security of conventional air assault teams during deep battle. FM 1-112 is especially good in its description of helicopter escort tactics and its discussion of suppression of enemy air defenses (SEAD). FM 1-113, on the other, gives a supported unit's perspective on the role of escort and SEAD aircraft. MACR 55-54, MAC Helicopter Operations, also provides a good source of helicopter gunship employment considerations. The Air Force Special Operation Command Manual 3-1, Volume III, Vertical Lift Tactics (Secret) deals with helicopter evasion procedures and not air-to-air combat or suppression of enemy air defenses (SEAD). Attachment 5 (Unclassified) specifically concerns escort helicopters. It is procedurally oriented towards forcible entry against ground fire and does not address SAMs or interceptors. Though it is narrow in its orientation, the procedures would be applicable during clandestine missions should the infiltration or extraction be compromised at the landing or pickup zone.

Friendly Capability

Jane's All the Worlds' Aircraft was the best unclassified source concerning the current and projected capability of SOF helicopters and the sample escorts addressed by this thesis. Defense Helicopter World, a British magazine published for the worldwide helicopter community, and Aviation Week and Space Technology, an American publication, were additional unclassified sources of performance data and aircraft specifications. While Jane's and the magazines might not be as accurate it could be were the classified data used, it was correct enough to make comparisons between aircraft and allow one important prerequisite--unclassified discussion.

[1] JCS Publication 3-05, Doctrine for Joint Special Operations (Washington, DC: The Joint Chiefs of Staff, 1989), p I-1. It should be noted that this and other references from JCS Pub 3-05 are reflected, almost verbatim, in both the Army and the Air Force regulations.

[2] Mitchell M. Zais, "LIC: Matching Missions and Forces," Military Review, Vol 66, No 8 (August 1986), p 96.

[3] FM 100-20/AFM 2-20, Military Operations in Low-Intensity Conflict (Washington, DC: Hq Departments of the Army and the Air Force, 1987), p 1-1.

[4] JCS Publication 3-05, p I-3.

[5] The British Special Forces in Burma felt they had achieved perfect harmony with the American Air Commandos supporting them. They were convinced that this was because these airmen were soldiers, Army Air Force, rather than the RAF who had a tradition of independence from the other Services. Bidwell, p 65.

[6] Hq 23d Air Force Briefing, Doctrine and Command Relationships, p 12.

[7] JCS Publication 3-05, p II-1.

[8] JCS Publication 3-05, p C-1.

[9] Shelford Bidwell, The Chindit War: Stilwell, Wingate, and the Campaign in Burma: 1944 (Macmillan Publishing, 1979), p 64.

[10] R.D. Van Wagner, 1st Air Commando Group: Any Place, Any Time, Anywhere, Military History Series 86-1 (Maxwell AFB, AL: Air Command and Staff College, 1986), p 103.

[11] Unit History, USAF Special Air Warfare Center (TAC), 1 April - 31 December 1962, p 2.

[12] Richard D. Newton, "A US Air Force Role in Counterinsurgency Support," Airpower Journal, Vol 3, No 3 (Fall 1989), pp 69-70.

[13] Representative Dan Daniel, "The Case for a Sixth Service," Armed Forces Journal International (August 1986), p 72.

CHAPTER III

METHODOLOGY

> Present equipment is but a step in progress, and any air force which does not keep its doctrine ahead of its equipment, and its vision far into the future, can only delude the nation into a false sense of security.
>
> General Henry H. "Hap" Arnold[1]

The methodology is based upon the Concept Based Requirement System (CBRS), developed by the Department of the Army in 1984. This decision-making process supports efforts to plan and program for future equipment, doctrine, training, and force structure. CBRS was designed to develop solutions to identified needs, analyze the comparable cost-benefits of proposed responses, and prioritize the solution(s) within the Services' modernization plans.[2] It forms the basis for integrating and synchronizing doctrine, training, leader development, organization, and materiel requirements across functional areas and between branches and the Services.[3] This three phase, systems-based approach ensures new weapons, organizational structures, and technologies are rationally integrated within a prioritized, operationally valid scheme.

Phase One of the CBRS is Concept Formulation. Beginning with an historical perspective, and integrating the current and projected threat, evolving technology, current doctrine, and friendly capability, a Concept is developed. (See Fig 3-1.)

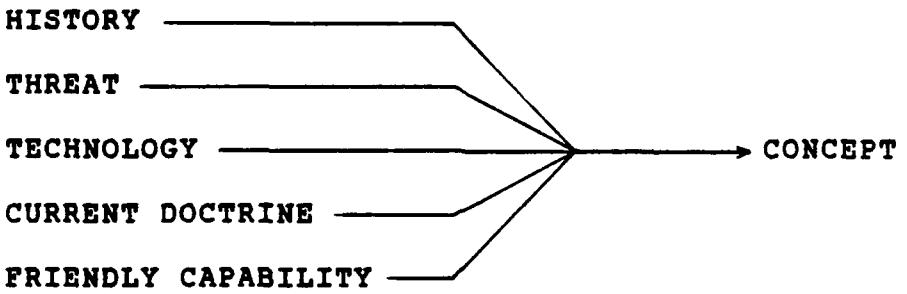


Fig 3-1.

A concept differs from doctrine in that a concept identifies required, but not yet attained, capabilities for the future. Doctrine, on the other hand, addresses the application of current capability on the present battlefield.[4] These future capabilities are translated into concepts to guide system development. In the process of formulating the concept, planners and combat developers must consider history and lessons learned to avoid repeating past mistakes. While historical analysis does not in itself prove nor disprove a concept, it does establish a body of evidence which brings one to the threshold of a concept.

Current doctrine serves as the baseline from which to begin future projections. The current and projected threat are key to focusing efforts. For the purpose of this study, a Soviet-based, Third World scenario is assumed. While the Soviet Union is still a significant threat, the proliferation of capable air defense systems among developing nations was the original impetus for this study. It is essential that planners and combat developers understand and take note of future US capabilities, especially as the prospect of significantly reduced budgets and force structure affects resource allocation.[8] Simply put, the process can be described as US capability minus current and projected Threat equaling deficiencies.

The goal of the Concept Based Requirement System is to solve identified deficiencies without developing new equipment. Within the TRADOC Life Cycle System Management Model (See Fig 3-2.), the conclusion of CBRS brings the planners to Milestone Ø. This methodology tracks a weapon system from inception through maturity. If, while working through the CBRS phases, the combat developers determine that the deficiency can not be resolved by changing doctrine, training, leadership development, or organizational structure, then the branches or integrating centers can pursue a materiel solution.

Within CBRS, the optimum solution to any problem, in terms of cost to the nation and speed of resolution is not materiel development. Changing doctrine, training, leader development, or organizational structure are easier and cheaper to accomplish. For most problems, CBRS should change these areas and avoid materiel solutions whenever possible.

LIFE CYCLE SYSTEM MANAGEMENT MODEL

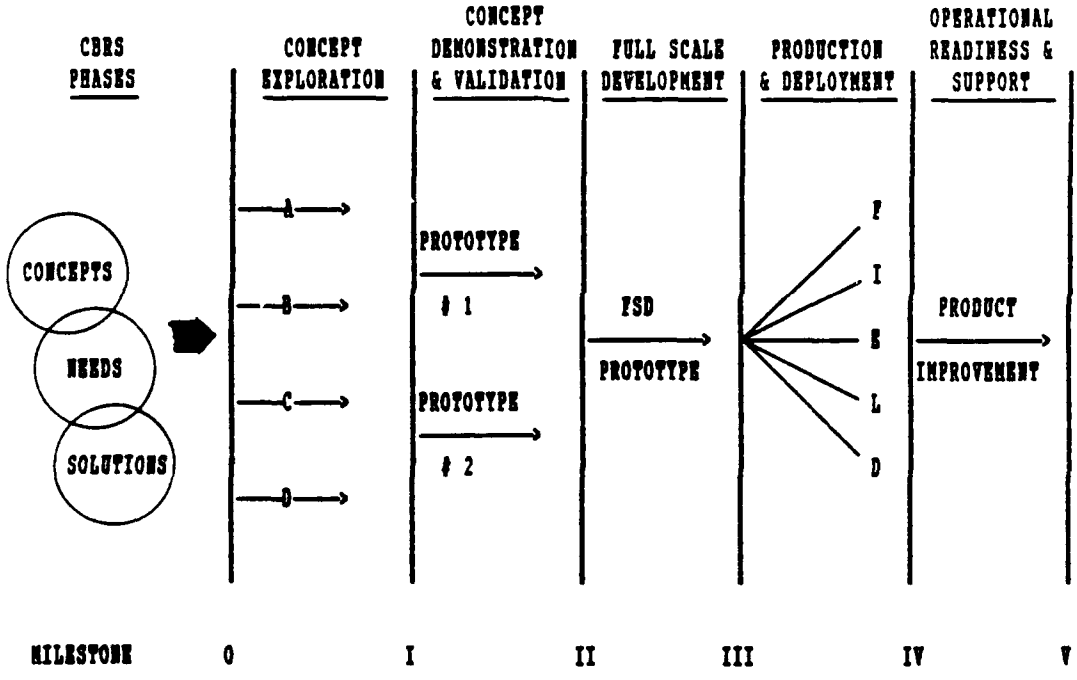


Fig 3-2.[6]

In the process of conducting Phase One, the planner necessarily overlaps with Phase Two, Identifying and Prioritizing Needs. (See Fig 3-3.) A perceived need generates the hypothesis which begins the CBRS process.[7] Within Phase One, the consideration of deficiencies and

opportunities is not as comprehensive as in Phase Two. During Phase Two, combat developers within the branches and at integrating centers provide the analytical support to further evaluate and refine the concepts.* This thesis will only conduct Phase One of the CBRS and formulate a Concept for armed escort of long-range SOF helicopters. Subsequent Phases are left to the weapons systems experts, branches, and integrating centers.

Fig 3-3.*

Current Army and Air Force doctrine already supports the requirement to protect certain aircraft from air and ground defense threats. This escort doctrine applies to deep strike fighter-bombers, tactical airlifters, air assault helicopter formations, command and control assets, and many other mission essential combat multipliers. Such doctrine does not exist for special operations helicopters, however.

Chapter Four establishes the context for armed escort of mission aircraft by presenting an historical perspective. Beginning with the World War II Combined Bomber Offensive against Germany, the history continues through Korea and Vietnam. The review of the history graphically shows the relationship between tactics and weapons technology. It is a

process that rarely remains in equilibrium. The lessons learned provide a solid foundation from which to examine the future of long-range special operations helicopter security needs.

Chapter Five is an Order of Battle Analysis. This section compares current doctrine and capability against the current and projected threat. From this analysis comes the projected deficiencies. Further studies examine the deficiencies in greater quantitative detail to produce the Systems Concept. In the course of producing the Systems Concept, planners look at the possible utilization of other weapons already employed by other battlefield functional mission areas, the impact of their solution on other systems, and quantify expected increases in capability.[10] That, however, is beyond the scope of this study.

Chapter Six is the Conclusion and Recommendations. It is here that the study presents the Operational Concept. In addition, the thesis offers other considerations which should be considered as part of the CBRS and Areas for Further Study. These are are valid issues, but beyond the scope of this study. By formulating the Operational Concept during Phase One, combat developers, weapon systems experts, and force structure planners can further evaluate and refine the Concept to Identify Needs and then Identify Solutions.

[1]General Henry H. Arnold, AFM 1-1, Functions and Basic Doctrine of the USAF (Washington, DC: Hq Department of the Air Force, 1979), p 4-11.

[2]TRADOC Regulation 11-15, Concept Based Requirements System (Ft Monroe, VA: Hq US Army Training and Doctrine Command, June 1989), p 3.

[3]TRADOC Regulation 11-15, p 3.

[4]TRADOC Regulation 11-15, p 5.

[5]TRADOC Analysis Command Briefing Script, Overview of Concept Based Requirement System, 1989, p 6.

[6]Combat Developments Briefing, US Army Training and Doctrine Command, 1990.

[7]TRADOC Regulation 11-15, p 5.

[8]TRADOC Regulation 11-15, p 7.

[9]TRADOC CBRS Briefing Slides, p 9. These slides accompany the script, Overview of Concept Based Requirements System.

[10]TRADOC CBRS Briefing, p 7.

CHAPTER IV

HISTORICAL PERSPECTIVE

> "Fools," said Bismarck, "say they learn by experience. I prefer to profit by other people's experience." The study of history offers that opportunity in the widest possible measure. It is universal experience--infinitely more varied than any individual's experience.
>
> Sir Basil H. Liddell Hart
> Why Don't We Learn from History?[1]

As Sir B.H. Liddell Hart said, history allows one to profit from others' experience. While history rarely causes changes in doctrine, tactics, or procedures on its own merits, history does bring one to the threshold of change. Studying the history allows one to comprehend the origins of and rationale for current doctrine. More importantly, it allows one to glean an appreciation of the influence of weapons technology upon the battlefield. This chapter looks at the continuing cycle of tactics versus weapons technology in air warfare so that one may benefit from lessons others learned.

The following examples illustrate how air forces and air defenders, as each achieved a relative advantage, changed tactics or technology to restore parity. Protective escort

was typically the tactical solution that allowed the bombers or transports to successfully continue their missions. SOF aviators on the other hand, usually developed specialized tactics and applied innovative systems (e.g., air-to-ground radios, night vision goggles, and terrain following radar), rather than using escorts to fight their way to a target. Specialized systems and tactics have allowed SOF helicopters to avoid detection and continue to perform their missions with relative impunity until recently. As the discussion of the changing threat will show, that freedom from detection and interception is rapidly fading.

The Air Force's experience during the bomber campaigns of World War II and Korea, as well as the special operations, air assaults, and combat rescues conducted during Korea and Vietnam provide significant lessons about protecting slow, ungainly airplanes and helicopters from state-of-the-art interceptors and air defenses. As conventional forces learned, forcing one's way to a target can be costly in the face of determined defenders. While special air operations rarely intend forcible entry, the increasing threat to helicopters conducting these missions requires that forces be capable of fighting their way out of compromised situations. Contemporary exercises and joint training programs seem to confirm the validity of those historical lessons for special operations helicopters today.[2]

The tradition and experience in special air operations has mostly been specialized airlift. The aerial fire support mission within special operations utilizes many of the tactics and procedures, but is outside the purview of this paper. Furthermore, by their nature, once air support missions open fire, they are no longer clandestine. The secretive nature of special air missions necessitated the fewest possible aircraft be involved to reduce the probability of detection. Furthermore, forcible entry into a target area negates all clandestine aspects of a mission.

In addition, because special operations airlift has been a secondary, or in many cases tertiary, mission, there have never been enough national or theater resources available to fulfill all the unique training and equipment needs of special operations aviation. As long as SOF aviation could successfully accomplish their missions, the community has preferred to concentrate on developing specialized tactics and employing uniquely capable systems.[3]

The consequence of employing unique tactics and systems has been impressive stealth and the ability to operate with almost complete freedom within enemy airspace. The threat today is changing that, though. Until recently, there was almost no need to consider defensive counterair issues

such as air-to-air combat and suppression of enemy air defenses (SEAD) within special operations aviation. This lack of defensive counterair experience has hindered the development of escort doctrine within the special operations aviation community. Since World War II, the advantage between air offense and air defense has shifted between the offense and the defense. It is quickly swaying towards the defense once again. As more and more countries procure advanced early warning and SAM systems, the possibility of compromise or engagement is greater than it ever has been. The nature of the threat has also changed as more countries acquire interceptors able to fight at night, normally the sanctuary of special air operations. The time has come to expand the mindset, to adapt to the evolving threat.

World War II

Prior to World War II, the advocates of airpower, men like Guilio Douhet of Italy, Billy Mitchell of the United States, and Sir Hugh Trenchard of England, declared that high altitude, long-range bombers would be the key to victory in future wars. Drawing on their World War I experiences and the tests they and others conducted between the world wars, these airpower proponents felt the heavy bomber was virtually invulnerable to air defenses. They believed that technology had made their modern bombers an invincible instrument of military power. With their superior striking power, speed,

and freedom from surface limitations, these men believed that great fleets of unescorted, invulnerable bombers were the ultimate offensive weapons.[4] The bombers' superior technology ensured, in the bomber proponents' minds, that no enemy could stop them.

Air defenses between the World Wars technologically lagged behind the bombers. Bombers flew higher and faster than contemporary fighters. Colonel Clayton Bissel, a World War I ace and early advocate of unescorted bombing, suggested early during World War II that the only way an interceptor could defeat a bomber was to drop a ball and chain into the propeller.[5] Antiaircraft artillery was believed to be futile against the bombers. Early warning radar was in its infancy in 1941 and available only to the most technology advanced Western nations. Detecting incoming bombers depended in large measure upon a visual sighting and then a verbal report to air defense controllers.

Tests conducted between the wars tended to uphold the bomber supremacy theory. As fighter and early warning technology improved though, interceptors achieved better results. Recognizing that improvements in air defenses threatened their theory, the bomber advocates in the US and England added guns and armor to their bombers. They also grouped the bombers into large formations to achieve mutual

fire support to counter defending fighters. Even though technology was rapidly negating the tactical advantage the bombers enjoyed over the defenders, the idea of fighters escorting the bombers was still eschewed.

During the early years of WW II, both the Royal Air Force (RAF) and the Luftwaffe found daylight bombing to be more accurate. It was far too costly in terms of airplanes and crews lost to maintain, though. The RAF and the Luftwaffe switched to night bombing, sacrificing bombing accuracy for survivability. This change in tactics kept most interceptors out of the fight and essentially blinded the AAA. The bombers only had to contend with AAA working with searchlights and primitive radar, and a limited number of enemy night fighters.

When the US entered the war in 1942, the Army Air Corps leadership planned to demonstrate the validity of daylight precision bombing. Advocates of fighter-escorts were largely ignored.[6] Moreover, the bomber advocates pointed to the fact that these "battleships of the air" were so heavily armed they did not need protection from intercepting fighters.[7] Finally, admitting the need for fighter-escort would have cast doubt upon the validity of the US's invincible bomber theory.

England continued its night bomber offensive, with the US hitting targets during the day. The horrendous losses suffered by day bomber formations attacking beyond the range of fighter-escorts made the British reject the American doctrine. The US continued, however. They maintained that the reasons for the high losses were that the formations were not big enough or that the bombers had not stayed close enough together to provide adequate mutual support. The cost of unescorted bombing was finally driven home in 1943, after the costly attacks against the ball bearing plants in Schweinfurt and the Messerschmidt assembly plant in Regensburg.

The Army Air Corps leadership felt the Schweinfurt and Regensburg targets were so important to the allied cause, that they resolved to hit them in August 1943, before long-range escorts were available.[8] Unfortunately, the bombers suffered 15% losses at Schweinfurt and 16% at Regensburg. During the reattack on Schweinfurt in October, the bombers suffered over 20% losses.[9] General Ira Eaker, commander of the Eighth Air Force observed that the "Schweinfurt missions had indeed been costly, too costly to pursue at that rate of combat losses. Penetration of German air space had to be limited until long-range fighters could be provided."[10]

The toll of US bombers lost to defending interceptors dropped correspondingly as the range of escort-fighters

increased. By March of 1944, P-51 Mustangs had sufficient range to protect the bombers all the way to targets in Germany and back to their bases in England. Strategic air forces, with their heavy bombers and long-range escorts could hit targets almost anywhere in Germany and penetrate the defenses to reach them with tolerable losses.[11]

Half a world away in the jungles of Burma, the conventional air force was learning how to counter the air defense by means other than forcible entry. General Henry "Hap" Arnold had committed American airpower to support the British Special Force long range penetration units under Brigadier Orde Wingate.[12] In 1943, Colonel Phillip G. Cochran and the 1st Air Commando Group built upon the pioneering work done during Wingate's first Burma expedition to expand airpower's support to special forces operating deep (250 miles) behind enemy lines.[13] By developing and employing unique tactics with conventional transport aircraft and equipment, they provided the vital links between support bases in India and the Special Force units in the field. Airdropping supplies to the troops was not a new idea, but the extremely rugged jungles and mountains of Burma required close coordination and unprecedented accuracy.[14]

London and Washington viewed Burma as a tertiary theater during World War II, and therefore dispatched few

Allied fighters to protect the US transports from Japanese fighters.[15] Even within the China-Burma-India theater, first priority went to flying supplies over the Himalayas into China, not to support tactical operations in Burma.[16] As one of General Joseph Stilwell's staff officers observed, by "common consent of the Allies, [Burma was] a low priority operation, to be attended to with whatever was left over after more important matters had been taken care of, Europe and the Pacific."[17] Those fighters sent to the 1st Air Commando Group were older P-51s. Their primary mission was to provide close air support to the Special Force battalions because artillery was too heavy and cumbersome to drag through the jungle.

With no land routes through the jungles, the Wingate's battalions' only link to their support bases was by air. Because the Allies did not have air superiority in Burma, 95% of the Air Commando resupply and reinforcement missions were flown at night to avoid the Japanese fighter threat.[18] By developing specialized tactics and innovative uses for standard airdrop and communications equipment, the Air Commandos enjoyed outstanding success. Hap Arnold subsequently concluded that "the conquest of Burma brought to light new concepts and tactics in warfare. [This operation] showed that whole armies can be transported, supported, evacuated, and supplied entirely by air."[19] Unlike the

bomber campaign in Europe, the air campaign in Burma used a tactical solution to counter the technological air defense threat posed by Japanese interceptors.

It is interesting to note the differences between air operations in the two theaters of war. During the bombing campaign in Europe, the bombers intended to fight their way to the target, the resources dedicated to the campaign were relatively unconstrained, and the enemy was a technologically advanced, Western military power with integrated belts of air defenses. This was forcible entry in a primary theater of war, so the US committed itself to develop adequate fighter-escort to protect the bombers. The aerial resupply operations in Burma, though, required a different tack. The enemy was trained and equipped for light, jungle warfare, had widely dispersed pockets of air defenses, and the Allies limited the resources dedicated to the fight. Here, the security issues were addressed by night, low-level operations, avoiding the threat rather than fight into and out of the target.

Korea

The advent of jet aerial combat did not ameliorate the necessity for armed escort of slower, vulnerable bombers and other specialized aircraft such as airlifters and rescue helicopters. During the evacuation of noncombatants following the initial North Korean invasion, not a single refugee was

lost or injured during the massive air exodus. This was in no small part attributable to the fighter cover afforded the transports. During one instance, on 27 June 1950, the North Korean Air Force tried to destroy the cargo planes on the ground at Kimpo Airport, (outside of Seoul) during two separate attacks. The American fighters kept the North Koreans away from the airlifters and the transports made it safely to Japan.[20]

North Korean air defenses were significant during the day. The Chinese had about 450 MiGs in the theater and would launch interceptor forces of 150 MiGs at a time to stop the bombers.[21] North Korean air defense radars were well developed and interceptors and AAA were integrated into a coordinated network. B-29s, state-of-the-art bombers only six years earlier at the end of World War II, were woefully outclassed by the Soviet-supplied jet fighters used by the North Korean and Chinese Air Forces. Escorting the bombers proved very difficult for the US jet fighters because they were so much faster than the bombers. Although the F-86s had the range to fly to the same targets as the B-29s and return, they were so much faster than the bombers, and their fuel load was such that they could only stay in the target area about 25 minutes.[22] This endurance problem severely restricted the F-86s' ability to protect the bombers. B-29s flying in the large formations used during World War II, suffered

unacceptable losses and achieved poor strike results, similar to the World War II unescorted bombers, when opposed by the modern, well-developed air defense network of North Korea.[23]

When the priority of the target justified the effort, the F-86s staggered their takeoffs to provide escort protection in relays.[24] Because this took so many fighters away from other missions, the relay system restricted the overall United Nations air effort. Air commanders avoided committing the large number of jet fighters necessary to conduct the relays unless it was absolutely necessary. For the most part, the bombers were restricted to night attacks after October 1951, unless they had fighter escort.[25]

Initially, American bombers had realtive freedom at night. The North Koreans limited their interceptors to day, clear weather operations. By 1952, however, the North Koreans had linked their radars to powerful searchlights. This allowed intercepting fighters to see the bombers and also improved AAA's chances of getting a good shot at the bombers.[26] To counter these North Korean defenses, the Air Force again dedicated fighters to strafe the searchlights and protect the bombers.

The Korean War also saw the first major combat use of helicopters. Both the Army and the Air Force used helicopters

for medical evacuation and combat rescue. The North Koreans, appreciating the value of pilots and soldiers returned to combat duty, tried to intercept the rescue helicopters. The Air Force used F-51 Mustangs to escort the H-19 rescue helicopters attempting to rescue pilots shot down behind enemy lines.

The F-51 had sufficient range and endurance to escort the helicopters during the entire mission, plus the speed, agility, and firepower to protect them from ground threats.[27] They were no match for the North Korean jets, however. If discovered by North Korean interceptors, US jet fighters on alert responded to the threat.[28] Because the duration of the fighter versus helicopter engagement was usually quite short, the time it took for the jet fighters to respond often exceeded the time the rescue helicopters were engaged. The preferred tactic was to avoid detection, and if discovered stay low enough to dissuade the fighter from engaging.

Vietnam

During the Vietnam War, the North Vietnamese, with Soviet and Chinese help, developed the most heavily defended airspace in the world around Hanoi and Haiphong. For the conventional air assets, it can be argued that the advantage shifted from the offense to the defense. During the early

part of the US involvement in Vietnam, the air defenses consisted of rudimentary radar and conventional AAA.[29] By the mid-1960s, though, the air defense system became an integrated network of early warning and fire control radars, surface-to-air missiles, antiaircraft artillery, and fighter interceptors. North Vietnamese efforts caused the loss of more modern US fighters and other aircraft than most would have expected from an underdeveloped nation. The North Vietnamese investment in air defenses and early warning systems almost negated the offensive power and flexibility of the US tactical air forces. The primary reason for the high losses, was that in general the US pilots "underestimated the power of the defense and the abilities of the North Vietnamese."[30]

North Vietnamese introduction of the SA-7 Grail in 1972, a shoulder fired, heat seeking, man-portable, surface-to-air missile (SAM), changed the character of the air war. This small, highly capable missile gave them a "potent weapon against air power. It put the slow-moving, low-flying aircraft, especially helicopters and propeller aircraft, at considerable risk."[31] When comparing the statistics, it only required two SA-7 missiles fired per helicopter shot down, compared with ten missiles for each slow-moving airplane, and 135 for each supersonic F-4.[32]

Because of their slow speed and mechanical complexity, helicopters have always been vulnerable to antiaircraft and small arms fire. Initially ill-prepared to meet the demands of aircrew rescue in Southeast Asia, Air Force rescue personnel had to develop innovative tactics and doctrine. During Korea, the integration of rescue helicopters and protective fighters was "done informally and ten years later, when the first Air Rescue Service choppers arrived in SEA, the concept of using fighters for rescue [helicopter] escort . . . had not been formally recognized within the Air Force."[33]

During Vietnam, technology was such that US helicopter operations were limited, except in very rare occasions, to daylight and clear weather. This dictated a tactical change while industry searched for a technological solution to improve helicopter survivability. Unlike the pilots in WW II, Vietnam era aviators had to contend with SAMs as well as AAA and interceptors. Because the rescue of downed pilots could be done without secrecy and was often performed in the face of determined resistance, the Search and Rescue Task Force (SARTF) evolved.[34]

SARTF tactics called for two A-1 close air support aircraft to circle the helicopters and escort them as they flew to the target. The other two A-1s would fly ahead to draw enemy fire prior to the Jolly Green Giant rescue

helicopter's arrival. Should the A-1s receive groundfire, they attacked the enemy with bombs, rockets, and cannon. When the A-1s and the forward air controller (FAC) were satisfied that the area around the survivor was safe for the helicopter, the first Jolly Green attempted the rescue. Should the hovering helicopter receive fire, the A-1s would ring it with white phosphorus smoke to degrade the enemy's vision and then attack the enemy's air defenses.

South Vietnam, North Vietnam, and Laos each posed unique problems for rescue helicopters and their escorting Sandys. The problem of rescue escort first focused upon Laos where aircrews that went down faced capture and almost certain death if not picked up quickly. "Very early in the war the North Vietnamese and their Pathet Lao allies became adept at setting up flak traps, which proved very dangerous for helicopter operations."[35] The rescue helicopters and their A-1 escorts shared the risks of an extremely dangerous job. By 1967, the A-1 had the highest overall loss rate of any airplane in Southeast Asia.[36]

Like the F-51 Mustang of the Korea War, the vintage, propeller-driven A-1 Sandy met the needs of combat rescue and special operations escort better than any other aircraft at the time. One factor which favored the A-1 was even though it was faster than the helicopters, it was not so fast that it

could not perform in their low, slow operating environment. Late in the war, the Air Force retired the A-1s and substituted A-7s to escort the special operations and combat rescue helicopters. These very capable and survivable jets were too fast to stay with the helicopters. More importantly, though, they did not have the endurance needed to protect the helicopters during the entire mission. Like the F-86s escorting B-29s in Korea, excessive numbers of A-7s had to be devoted to the mission so that they could "relay," one pair staying with the rescue helicopters while the other pair refueled inflight.

The introduction of night vision systems adequate for tactical night flying in this complex air defense environment came too late in the war to change mindset or tactics. Over the years, equipment improved and the aircraft changed, but by the end of the war, the search and rescue task force still resembled that of 1965 in doctrine, tactics, and procedures."[37] Because of their mission, the combat rescue forces developed necessary tactics and procedures to survive enemy air defenses.

During the Vietnam War, the Army developed the concept of airmobility with helicopters. The staggering losses they suffered in manpower and machines early in the war made them realize that lift aircraft needed protection from the ground-

based air defenses. After much experimentation with gun and rocket systems attached to utility helicopters, the Army and Bell Helicopters developed and fielded the AH-1 HueyCobra. This was the first helicopter designed and built for ground attack. The significant firepower, agility, and greater relative speed of the AH-1 made it an excellent platform to protect the slower, relatively unprotected lift helicopters.

During the mission to rescue the crew of the Mayaguez, F-4 and A-7 jet fighters, AC-130 gunships, naval gunfire, and helicopter organic gunfire were used to support the special operations and combat rescue helicopters. As the helicopters inserted, resupplied, and extracted the Marines from Koh Tang Island, there was plenty of air-to-ground jet fighter support available. The A-7s and F-4s had minimal effect on the enemy, however. "Despite the cumulative effects of daylong airstrikes . . . up and down the length of the treeline, enemy resistance was almost fanatical."[38] The enemy was in well prepared and concealed positions under dense jungle canopy. It was wasteful to use high speed fighter-bombers to try and destroy the defending forces. When the helicopters went in to extract the Marines, they still recieved concentrated groundfire from as close as 50 meters away.

One tactic that did work during Mayaguez, although the relative value might be disputed, was having the helicopters

cover each other using onboard 7.62 miniguns. These Gatling-type machine guns were designed to spew large quantities of bullets and tracers at a rate of 4,000 to 6,000 rounds per minute. They were intended for area suppression, rather than precise fire support and target destruction. Because they kept the defenders' heads down, they provided some protection, but they could not destroy enemy positions. They, too, were mostly ineffective against dug-in troops. One participant observed:

> The helicopters flew cover for each other . . . the fighters were worthless. In fact, the F-4s were strafing our helicopters because they couldn't distinguish us from boats in all the smoke and haze. Helicopter miniguns kept the enemy gunners' heads down and that worked well, but it didn't neutralize the bunkers and gunners. The AC-130 was good, except even it was stymied by the triple canopy jungle. It's funny, but the best thing we had out there was that FAC, the OV-10 Bronco with his M-60 machine guns. He could get down on the water where we were, was slow enough to visually acquire the target, and had good cockpit visibility. He didn't have the firepower to destroy the 37 mm guns, but he killed the crew and it gave our helicopters time to get onto the beach.[39]

Like the guns on B-17s during WW II, self-protection weapons on the helicopters were an acceptable, though hardly perfect, interim solution. With A-1s unavailable and Army HueyCobra attack helicopters lacking sufficient range and endurance to fly from bases in Thailand, high speed fighter-bombers, AC-130 gunships, and onboard miniguns were the best protection available. Although the fighter-bombers and AC-130s tried their best to support the helicopters, the

dense jungle, smoke and haze, prepared defensive positions, and limitations of high speed aircraft in a high threat environment degraded their efficacy.

Summary/Lessons Learned

As in most forms of combat, technological and tactical advantages are fleeting in aerial warfare. Prior to World War II, it was considered gospel that nations could not actively defend against strategic bombers. Passive defense, minimizing the effects but not the number of bombs dropped, was considered the only recourse available. As interceptor technology improved, the bombers changed tactics by flying higher and faster to protect themselves. Self protection was an interim measure while industry worked to improve survivability of the bombers.

Also prior to World War II, it had been predicted that the bombers would need protection by fighters from enemy defending fighters. Generals "Hap" Arnold and Carl Spaatz were not fully convinced that unescorted bombers could succeed, but they were faced with the dilemma of putting enough fuel in the escort planes while keeping them light enough for maneuverability and speed.[40] Even during the early days of the European bombing campaign, the advantages of fighter protection were noted.[41] Once technology gave the fighters adequate range to protect the bombers for

the entire mission, tactics and doctrine were adjusted to exploit the new capability. The Allied use of fighter-escorts allowed the bombing campaign to continue and reduced bomber loss rates to acceptable levels.

As Field Marshall Slim noted, there were very few resources dedicated to the Burma theater.[42] To make matters worse, Allied troops in Burma stood at the very end of the longest supply line in history.[43] This ensured that they would be chronically short of everything necessary to conduct a modern war. Wingate's and Cochran's tacticians devised innovative solutions to maintain the flow of supplies to Wingate's Special Force battalions. Because the Allies in Burma were were resource constrained and the Japanese had no radar or ground-to-air control equipment, there were alternatives available in this sparse air defense threat that were not in the heavily defended skies of Europe. In Burma, the Air Commandos pioneered the night, low-level tactics that became the hallmark of future special operations aviation. In their case, adversity fostered the innovation necessary to maintain their offensive flexibility and initiative.

In Korea, the technology-tactics cycle continued. Improved air defense technology dominated the air war again. Changing tactics to night operations and diverting

significant fighter resources from the other aspects of the air campaign provided an acceptable degree of protection to the bomber forces. By the end of the war, superior US equipment and the tactics developed to employ that equipment had negated the North Korean air defense threat and dominance of the air war had clearly returned to the US.

One of the subtle lessons from World War II escort operations was hammered home during the Korean air campaign. The necessity for compatible range and endurance was tragically obvious after the first few daylight bombing missions. On the other hand superior agility and speed was required in order to compete against opposing jet fighters. The tradeoff of compatible range and endurance for superior speed and agility created an exploitable weakness--the need for "relays" of fighters in order to provide continuous protection for the bombers.

Against North Vietnam, the United States faced the most sophisticated air defense system in the world. The US Air Force expanded the escort concept to include specialized electronic combat, defense suppression, reconnaissance, aerial refueling, and airborne command and control aircraft. These, along with the fighter-escorts, comprised a force package to protect the fighter-bombers. This same idea was applied to the protection of helicopters, in the form of the

SARTF, as they tried to rescue aircrew members shot down in enemy territory.

Special operations helicopters continued to adhere to the principles they developed in Burma and Korea, avoiding the threat by flying at night and using unique low-level profiles to maintain secrecy. Although procedures and tactics differed because of more and improved early warning radars and the introduction of surface-to-air missiles, the principles held true. Except for those missions when forced entry was required, special air tactics remained covert penetration, avoiding detection to ensure success of the mission.

During the Mayaguez operation, Air Force planners tried to apply the technology developed for the air war over North Vietnam and protected the helicopters with the most potent tactical air assets available. Unfortunately, these high speed fighters were the wrong weapon systems for the threat the helicopters faced; they were too fast and not equipped for precise ground attack against bunkers hidden in the jungle. The intent was commendable, but the effect was minimal.

Since the end of Vietnam, there have been attempts to integrate helicopter gunships with special operations and

combat rescue helicopters. While night, low-level capability has improved and is compatible among the various types, the range, endurance, and airspeed differences remain. (Appendix C) Today, the Army enjoys great success with scout and attack helicopters providing security for its air assault helicopters. Range, endurance, and night vision systems are compatible between the lift and the security elements. The speed, agility, and firepower of the escorts, though, have been maximized to enable them to provide effective security for the assault formation.

The current doctrine say that "modern air defense weapons allow the enemy to detect, acquire, and engage helicopters under all conditions of weather and visibility."[44] Although the intent of special air operations remains clandestine insertion, extraction, and resupply, the time has come to examine the need for greater protection than that afforded by stealthy tactics and specialized organic avionics. The protection must be compatible with current lift helicopters yet be dissimilar enough to successfully compete against defending interceptors and air defense systems.

> To survive, [special operations helicopters] must avoid detection by using proper operational techniques. If detected, they must deceive and degrade the Threat . . . If this is not possible, the units must destroy the Threat with organic and supporting fires.[45]

[1]Sir Basil H. Liddell Hart, Why Don't We Learn from History? (New York: Hawthorn Books, Inc., 1943), p 15.

[2]There have been many tests and exercises conducted over the years, from the local unit level to Service-directed, which point to the validity of armed escort for lift helicopters attempting deep penetrations of hostile airspace. Some have used special operations scenarios, though most concerned conventional air assaults. The bottom line, though, has been that lift helicopters are extremely vulnerable when intercepted and are ill equipped to fight their way out of a fight.

[3]The spirit of these crews is reflected in their motto, "Any Time, Any Where." It is the bravado born of special people who regularly perform a difficult and dangerous mission, overcoming insurmountable obstacles, and doing it safely, successfully, and better than anyone else.

[4]Giulio Douhet, The Command of the Air, trans. by Dino Ferrari (Washington, DC: Office of Air Force History, 1983), pp. 200-201

[5]Don Moser, World War II: China-Burma-India (Alexandria, VA: Time-Life Books, 1978), p 57.

[6]David R. Mets, Master of Airpower (Noveto, CA: Presidio Press, 1988), p 381. General Spaatz insisted that the initial deployment of the 8th Air Force in 1942 include a fighter command, dedicated to support the bomber forces. The severe losses of 1943 only reinforced his commitment to fighter-escort.

[7]"Battleships of the air" was a romantic term used after The Command of the Air, was translated into English in the early 1920s. This classical work about the influence of airpower on the character of warfare describes "battleplanes" flying with impunity over a nation's defenses.

[8]Haywood S. Hansell, Jr, The Strategic Air War Against Germany and Japan: A Memoir (Washington, D.C.: Office of Air Force History, 1986),p 85.

[9]Hansell, p 86

[10]Hansell, p 91

[11]Hansell, p 102

[12]Army Air Forces in World War II, Vol IV, The Pacific: Guadalcanal to Saipan, Aug 42 - Jul 44, editors Wesley F. Craven and James L. Cate (Chicago: Chicago University Press, 1950), p 502.

[13]Sir Robert Thompson, Make for the Hills (London: Leo Cooper Ltd, 1989), p 47. Sir Robert was Wingate's "air liaison officer" during 1st and 2d Chindits.

[14]Major R.D. VanWagner, 1st Air Commando Group, Military History Series 86-1 (Montgomery AFB, AL: Air Command & Staff College, 1986), p 16.

[15]Field Marshall Viscount William J. Slim, Defeat into Victory (London: Macmillan Publishers, 1956), p 225.

[16]Douglas M. Craver, Key to Victory: The Development of Air Supply Doctrine in the China-Burma-India Theater, 1941-1945, (Durham, NC: Duke University, 1970), p 74.

[17]Timothy Baker Shutt, "At War's Farthest End," Military History (June 1986), p 40.

[18]Joint Intelligence Collection Agency, China-Burma-India Report No 3137, 30 May 1944, p 3.

[19]General Henry H. Arnold, War Reports, with forward by Walter Millis (Philadelphia, PA: Lippincott & Co, 1947), p 449.

[20]Robert F. Futrell, The United States Air Force in Korea, 1950 - 1953 (New York: Duell, Sloan, and Pearce, 1963), p 12.

[21]Bryce Walker, Fighting Jets (Alexandria, VA: Time-Life Books, 1983), p. 62.

[22]General William W. Momyer, Airpower in Three Wars (Washington, DC: Office of Air Force History, 1978), p 147.

[23]Walker, p 62.

[24]Futrell, p 317-318.

[25]Futrell, p 645.

[26]Futrell, p 416-418

[27]After WW II, the Air Force changed the designation of its fighters from "P" for pursuit, denoting small, usually single-seat, fighter, interceptor, and attack type airplanes, to the more descriptive "F" and "A" meaning fighter and attack. For example, P-51s were redesignated F-51s.

[28]Earl H. Tilford, Jr, Search and Rescue in Southeast Asia, 1961 - 1975 (Washington, DC: Office of Air Force History, 1980), p 65.

[29]Kenneth P. Werrell, Archie, Flak, and AAA: A Short Operational History of Ground-Based Air Defense (Maxwell AFB, AL: Air University Press, 1988), p 99.

[30]Werrell, p 101.

[31]Werrell, 116

[32]Werrell, p 116

[33]Tilford, p 65.

[34]Tilford, p 62

[35]Tilford, p 65.

[36]Tilford, p 73

[37]Capt B. Conn Anderson, USAF Search and Rescue in Southeast Asia (1961-1966), Hq Pacific Air Forces Project CHECO, 1966.

[38]Captain Thomas D. Des Brisay, Fourteen Hours at Koh Tang, USAF Southeast Asia Monograph Series, Vol III, # 5 (Washington, DC: Office of Air Force History, 1985) p 142.

[39]Telephone interview with LTC Gary L. Weikel, 12 Oct 89. During the Mayaguez mission, 1Lt Weikel was the copilot of Jolly 11, one of the Sikorsky HH-53 Combat Rescue helicopters.

[40]Mets, p 112.

[41]James Parton, "Air Force Spoken Here" General Ira Eaker and the Command of the Air (Bethesda, MD: Adler & Adler, 1986), p 174, 177.

[42]Slim, p 225.

[43]Shutt, p 40.

[44]FM 1-112, Attack Helicopter Battalion (Washington, DC: Hq Department of the Army, 1986), p 3-2.

[45]FM 1-112, p 3-2.

CHAPTER V

ORDER OF BATTLE ANALYSIS

> The first question is what kind of fights are we going to get into in the future. And the answer, I suspect, is more of the same. I think the likelihood of an all-out war with the Soviets in Western Europe is pretty small . . . But we must prepare to fight it, or we can't deter it. I'd say it's a lot more likely we'll end up with more limited wars, like Korea or Vietnam or Afghanistan or the Persian Gulf or the Middle East or South Africa. So the capability to fight those wars is critical.
>
> The Minotaur[1]

As Admiral Henry told Captain Jake Grafton, the hero of Stephen Coonts' thriller The Minotaur, the first question to an Order of Battle Analysis, is to determine "what kind of fights are we going to get into in the future." Once one determines the most likely form of conflict, the next logical step is to define the current and projected threat. The threat, however, is very scenario dependent. The range of possibilities is astronomical. Theater staffs limit the possibilities by conducting risk assessments to maximize their apportioned capability against their most likely scenarios. Comparing the threat against current and future friendly capabilities determines the deficiencies and facilitates further development efforts by the Services.

What Kind of Fights?

> Low Intensity Conflict has remained and is likely to be the most prevalent threat to our security and to the peace that is so essential to our world.
>
> John O. Marsh[2]
> Secretary of the Army

This question is not easily answered. Conventional wisdom holds that because we have prepared to fight and win World War III, we have effectively deterred it. Conventional or nuclear World War III has become the least likely scenario (See Fig 5-1). The current nuclear threat constrains the

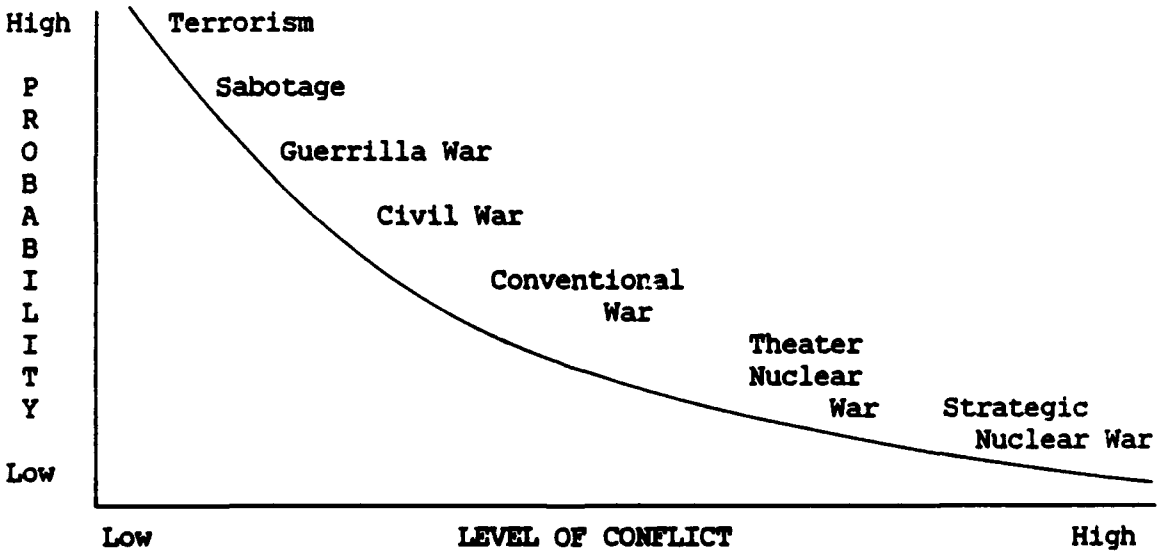


Fig 5-1.[3]

rivalry between the United States and the Soviet Union. The success of deterence and an increasingly interdependent world have changed the nature of superpower relationships. The danger of escalation inherent in war between the superpowers has encouraged the United States and the Soviet Union to rely on indirect forms of conflict.[4] Successful deterrence has

forced the Soviets, their allies, and their surrogates to focus on a level of conflict below conventional war, "low-intensity conflict."[5]

For over four decades, the United States has been involved in a continuing series of conflicts short of total war. Since 1945, the US has fought a type of conflict much different from that it was prepared to fight. Lieutenant General Wallace Nutting, the former commander of TRADOC, said about this limited type of warfare, "As a nation we don't understand it and as a government we are not prepared to deal with it."[6] Instead of conducting global operations against another superpower, the US fought limited, constrained and often frustrating wars against lesser powers or Soviet surrogates. Just as low-intensity operations have been the predominant form of combat for US forces in the past, it is likely to be the most prevalent in the future.[7]

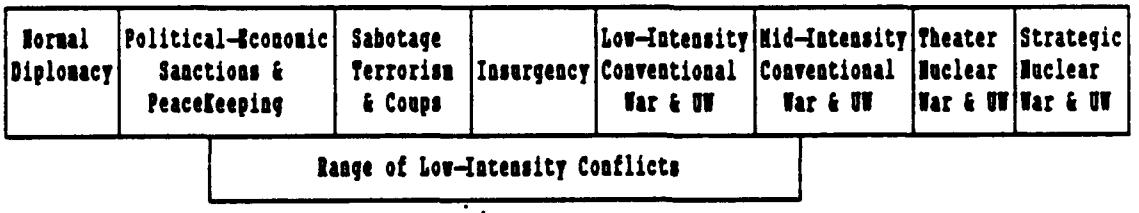


Fig 5-2.

Dr Richard Schultz, Jr, in Low-Intensity Conflict and Modern Technology, offered a model to describe the spectrum of conflict from normal diplomacy through strategic nuclear

holocaust. (See Fig 5-2.)[8] In an attempt to define the military actions in a LIC environment, he also showed what he thought the range of LIC to be as a subset of the total spectrum. Even this model, though it helps, does not really define low-intensity conflict. Some have said the deciding factor is mobilization. Mobilizing forces signifies a commitment of resources and national prestige by the United States, thereby raising the conflict above the level of "low-intensity."

Another school of thought posits that risk to national survival defines low-intensity conflict. Though LIC is probably the most likely form of conflict, the military risk it poses to the nation is relatively low, especially when compared to strategic nuclear war. This accounts for the military's doctrinal and budgetary preoccupation with the high end of the conflict spectrum. The JCS has said the single most important difference between LIC and war is the primacy of political considerations during LIC.[9] To the the soldier on the ground or airman in the skies, the key difference is that peacetime rules nearly always apply during LIC.

Whatever the definition, the term low-intensity conflict (LIC) reflects an American perspective. It may affect US interests, but rarely poses significant risk to national survival. To those directly involved, though, LIC is

a misnomer--the military aspect of LIC is high-intensity combat to those peoples and nations engaged in the struggle.[10] The title reflects the subtle and indirect nature of military actions in a LIC environment. It also tends to avoid the impact of the other elements of national power. Tactical operations by conventional and special operations forces may include such missions as raids, strikes, direct assistance, and shows of force.[11] While virtually all forces can be called upon to fulfill a specific role in a LIC environment, the critical nucleus for low-intensity military operations would likely be special operations forces (SOF).[12]

In the aftermath of Vietnam, the mood of the military and the nation shifted away from these uncomfortable type of wars, refocusing instead upon superpower confrontation in Europe. Towards the end of the 1980s, the US realized that these "little" wars posed significant challenges to its interests and could not be dismissed. Low-intensity conflict has since received a renewed emphasis. "The United States and its armed forces can expect to be involved in LIC and in operations to prevent LIC for the foreseeable future."[13]

Since WW II, the Soviet threat has been the customary driving force behind US foreign involvement. Because the American public is not particularly comfortable with its

international role, the recognizable, quantifiable, and overwhelming Soviet threat has justified US nonisolationist policies for the last 45 years.[14] While it can be argued that Soviet influence and threat has severely diminished, the prospect of fighting limited or low-intensity conflicts has not. In 1986, Secretary of State George P. Shultz said, "Low-intensity conflict is the prime challenge we will face, at least through the remainder of this century.[15] Four years later, that statement is even truer. The instability caused by political, economic, and social changes, and the rise of aggressive regional powers has significant potential to involve the United States in some sort of limited conflict. The development of these regional powers and the recent fragmentation of the communist bloc has caused the relative strength of the superpowers to decline.

The most significant threat to US interests in a LIC environment results from the accumulation of many individual instances of terrorism, coercion, accommodation, political setbacks, and bullying. Such outcomes can gradually isolate the United States from its allies and global trading partners, expand threats to key sea lines of communication, and possibly deny access to vital resources to the Western allies.[16] The aspirations of regional aggressive states is often undaunted by the United States or the Soviet Union. As the lesser powers pursue their own agendas, the possibility of

conflict "on the fringes" becomes greater. In the last ten years, the commitment of US forces into Iran, Lebanon, the Persian Gulf, Libya, and Panama indicate that the United States can and will resort to military force when its interests are at stake.

Although the primary role for US armed forces during low-intensity conflict is security assistance, the President can and will commit the military to direct intervention or supporting operations to uphold vital US national interests.[17] For special operations forces, this could entail any combination of Direct Action, Unconventional Warfare, Foreign Internal Defense, Special Reconnaissance, or Counterterrorist missions. Low-intensity conflict requires more than the traditional application of military power.[18] Because of its political, economic, and informational dimensions, LIC necessitates unique limits on the use of military power. These limits include the objectives, geography, level of violence, discriminate use of force, and duration of direct involvement. Because SOF normally operate in this extremely constrained environment, they are ideally suited to form the core of the US military response. William J. Olson, Director of LIC for the Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict, said, "While regular forces are very well prepared to meet challenges at the mid-intensity level of conflict and above,

their very preparations and their habits of mind do not make them equally prepared to cope with LIC . . . ."[19] Should conventional forces be introduced into a LIC environment, they must recognize the significant differences from their normal mode of operations and make the crucial adjustments in training and mindset.

Threat

It is a common misperception that Third World conflicts are fought by backward nations using antiquated equipment. Nothing could be further from the truth. "Friendly [special] air operations may be challenged by hostile air forces, SAMs, air defense artillery, and radio-electronic combat forces."[20] The sophistication of arms available on the world market is staggering. Long before the United States delivered Stingers to the Afghan rebels, they were using Soviet SA-7 Grail SAMs abandoned by the Afghani gunners, against the Soviet attack and transport helicopters.[21] Third World conflict does not mean "low tech" any longer. A more accurate assessment would be "lesser tech," especially when compared to US or Soviet capabilities. The types of defenses facing air forces in most scenarios are anything but antiquated.

In the last decade, the number of Third World nations able to field extremely capable air defense systems and

interceptor aircraft has blossomed. Although the cost of air defense weapons has increased, they are, and should remain, significantly cheaper than aircraft.[22] The proliferation of sophisticated weaponry among Third World states and extranational insurgent and political groups is well documented in official and unofficial sources.[23] (See Fig 5-3.) Even with the thawing of East-West relations, the Soviet Union appears committed to the same vigorous program of military modernization the world has been watching since 1945. As the USSR fields new and better weapons systems, their older ones are given or sold to allies and surrogates.

SOVIET THIRD WORLD MILITARY SALES 1980-1988					
	Mideast & SWA Asia	Sub-Sahara Africa	Latin America	East Asia & Pacific	Total
Supersonic Aircraft	1740	405	145	330	2620
Helicopters	1150	310	155	90	1705
SAM Systems	22000	6110	2600	1500	32210

Source: "Soviet Aerospace Almanac"[24]

Fig 5-3.

Technological advances and proliferation have fostered instability in the Third World by increasing the lethality and mobility of government forces and insurgent groups.[25] More and cheaper advanced weapons are available to almost anyone willing to pay for them. "The multinational export of weapons and technology is improving the capabilities of threat forces

worldwide."[26] It is reasonable to expect developed nations to continue their practice of selling or giving older, but very capable, air defense weapons and interceptors to the lesser developed nations as the industrial nations continue to upgrade their own weapons. Also, in order to keep production facilities in operation and to reduce costs through larger production runs, there are cases of lesser developed nations being offered the opportunity to purchase frontline systems.

Soviet planners, with their doctrine primarily oriented towards the offensive, are becoming increasingly aware of the threat to their rear areas from conventional and special operations forces. Terrain flight techniques and electronic warfare enable friendly forces to evade or degrade some threat air defenses. Because ground-based air defense systems are unable to provide complete protection, and "to increase their air defense capability, the Soviets plan to use their attack helicopters in antihelicopter roles."[27] Hardware developments, confirm the doctrinal reality of helicopter air-to-air combat that have been found in open source literature. The regional powers and Soviet surrogates, allies, and clients are adopting Soviet doctrine to accomodate Soviet-style doctrinal changes.[28]

As sophisticated and capable air defense systems proliferate throughout the Third World and Soviet trainers

spread their combined arms doctrine, clandestine missions into those countries will become just as complicated as they are into more developed nations. The great technological advances in firepower, mobility, and survivability are allowing Soviet client states and other hostile powers to project military power and national influence to an unprecedented level.[29]

According to the air defense manuals, the execution phase is basically a two step process--detection and targeting.[30] SOF helicopters avoid detection to deny the enemy the opportunity to target them. The ability to avoid fire control and surveillance radars has correspondingly decreased in direct proportion to the number of systems fielded. This increases the chance that SOF helicopters would be intercepted by opposing air defenders. Also, defenders employ overlapping systems to compensate for weaknesses of one by maximizing the capability of another.[31] Defeating an integrated air defense threat is the crux of the problem for special operations helicopters.

> The most evident trend in Soviet tactical air defense developments in recent years has been progressive increases in the size of the engagement envelope and the lethality of the weapons.[32]

Not only have the number of air defense systems throughout the world grown, but their capability has increased also. It is a qualitative, as well as a quantitative, increase in the threat to SOF helicopters. Surveillance and

tracking radars can see farther to detect aircraft at greater ranges. (See Fig 5-4.) More significantly, the newest radars can find and target low-level helicopters hiding in the ground clutter. More and more countries can deny SOF aviation the ability to penetrate and exit unobserved (Figs 5-6a, 5-6b, 5-6c, & 5-6d show a representative sampling of the types and improving capability of air defense systems available to and fielded by Third World nations).

THREAT CHARACTERISTICS
RADAR

RADAR	SYSTEM	FUNCTION	RANGE
Flat Face	SA-8, S-60	Target Acquistion	250 km
Land Roll	SA-8	Fire Control, Tgt Acquistion	25 km
Dog Ear	SA-9, SA-13	Early Warning, Tgt Acquisition	50 km
Long Track	SA-6, SA-8	Target Acquisition	150 km
Straight Flush	SA-6	Fire Control, Tgt Acquisition	60-90 km
Thin Skin	SA-6, SA-8	Height Finder	240 km
Flap Wheel	S-60	Fire Control	25 km
Gun Dish	ZSU 23-4	Fire Control	20 km

Source: Jane's Land-Based Air Defence
Fig 5-4.

Despite the influx of sophisticated air defense weapons, most developing nations have problems integrating this capability into their force structure and doctrine. In the Iran-Iraq War, for example, though both nations had a large supply of sophisticated weaponry, there was never a decisive battle nor a successful outcome of the conflict. The

capabilities of the systems seemed far in excess of the soldiers' and airmen's ability to understand them.[33]

The Iran-Iraq example illustrates a common problem. Semi-literate forces have not been able to maximize the use of the technology afforded them. This is a weakness SOF aviation can exploit for the near term. It can also be expected that a shortage of trained support personnel will hamper most attempts to establish and maintain modern air defense networks. Expertise in electronic warfare, both offensive and defensive, is probably the hardest skill to acquire.[34] By no means should this imply that the situation is static. It is reasonable to expect that as nations develop, they will improve the quality of their education and their support base, thereby eliminating many vulnerabilities.

The same holds true for high performance fixed and rotary-winged interceptors. (See Fig 5-5.) Though advanced radars and missiles are available, the technical and support base within many Third World nations is often marginal. The expense and logistics associated with the more modern aircraft and missile systems also makes it unlikely that many Third World nations can afford large numbers of them. The likely threat would be from more, less capable interceptors. The most modern and capable aircraft would probably be kept in reserve to guard high-value targets.

THREAT CHARACTERISTICS
INTERCEPTORS

MiG-21 Fishbed	23mm gun pods, 57mm rockets 500 & 1000 pound bombs, Atoll Radar/IR air-to-air missiles	1.1 Mach max S/L	Multirole fighter. 37 air forces. Poor fwd, rear, & downward visibility. Radar looks forward & up only.
MiG-23 Flogger	23 mm gun pod, Apex (radar) Aphid (radar/IR) air-to-air missiles.	.85 Mach max S/L	Counterair fighter. 25 air forces. Poor fwd, rear, & down vsby. Radar can track & engage targets below.
MiG-29 Fulcrum	Internal 30mm cannon, Alamo (radar) & Archer (IR) msls, 57 & 80 mm rockets, 500 & 1000 pound bombs.	1.1 Mach max S/L	Counterair fighter w/attack capability. Look-down/shoot down radar. Restricted vsby N Korea, Syria, Iraq, Cuba
Su-25 Frogfoot	Internal 30mm cannon, Atoll & Aphid msls, 57 & 80mm rockets, 500 & 1000 pound bombs.	.8 Mach max S/L 372 kts attack	Attack fighter. Poor vsby. No radar, IR/laser range finder & designator. Warsaw Pact & Iraq.
Mi-17 Hip-H	23mm gun pods, 12.7mm mach gun in nose turret, 57mm rockets, Sagger antitank missiles	135 kts Vne 129 kts cruise	Upgraded Mi-8 assault helo. Mi-8 in 39 air forces. Mi-17 in Cuba, India, Peru, Angola, & N Korea.
Mi-24 Hind	Spiral antitank & Aphid missiles, 23mm gun pods, 57 80mm rockets, 12.7mm mach gun turret, 3000# of bombs.	180 kts Vne 159 kts cruise	Extensive combat service in Chad, Angola, Nicaragua, Afghanistan & Iran-Iraq. Outstanding gunship.

Source: Jane's All the Worlds' Aircraft

Fig 5-5.

THREAT CHARACTERISTICS
ANTI-AIRCRAFT ARTILLERY (AAA)

	TYPE	RANGE	ACQUISTION	MOBILITY	MAX ALT	FIELDED
ZSU-23-4	USSR	2500 m	radar or optical	tracked, four barrel 23 mm	5100 m	1966
ZSU-57-2	USSR	5000 m	mechanical-optical	tracked, twin barrel 57 mm	6700 m	1957
S-60	USSR	6000 m	radar or optical	towed, 57 mm single-barrel	8800 m	1950
ZPU-2 ZPU-4	USSR	1400 m	optical, fixed sights	towed, 14.5mm 2 or 4 barrel	5000 m	1949
BTR-40 BTR-152	USSR	1400 m	optical, fixed sights	ZPU-2 mount on BTR	5000 m	1950
M-1939	USSR	3000 m	optical, fixed sights	towed, 37 mm	6700 m	1939
M-42	USA	5000 m	mechanical-optical	tracked, twin barrel 40 mm	9500 m	1951
M-163 Vulcan	USA	1600 m	optical, range-only radar	tracked, 20mm gatling gun	4500 m	1968

Source: Jane's Land-Based Air Defence[38]

Fig 5-6a.

THREAT CHARACTERISTICS
SURFACE-TO-AIR MISSILES (SAMS)

	TYPE	EFFECTIV RANGE	ACQUISTION	MOBILITY	ENGAGEMENT ALTITUDE	DATE FIELDED
SA-6	USSR	4-24 km	semi-active radar homing	tracked, non amphibious	50-12000 m	1967
SA-7	USSR	.5-5 km	infrared	man-portable	15-4500 m	1966
SA-8	USSR	2-12 km	command LOS radar	wheeled, amphibious	10-12000 m	1975
SA-9	USSR	.6-6 km	infrared	wheeled, amphibious	10-5000 m	1969
SA-13	USSR	.7-7 km	cooled IR & radar	tracked, amphibious	10-5500 m	1974
SA-14	USSR	.6-6 km	cooled IR	man-portable	10-5500 m	1978
SA-16	USSR	not avail	cooled IR	man-portable	not avail	1987
Blowpipe	UK	.7-3 km	command LOS radar	man-portable	10-2500 m	1975
Crotale	FR	.8-10 km	semi-active radar homing	wheeled, non amphibious	15-4000 m	1971
Roland II	GE/FR SP	.7-6 km	semi-active radar homing	tracked	10-3500 m	1981
Stinger	USA	.2-4 km	passive IR	man-portable	0-3500 m	1981
Hawk	USA	40 km	semi-active radar homing	towed	30-11000 m	1960
Redeye	USA	.6-3 km	passive IR	man-portable	25-3000 m	1968

Source: Jane's Land-Based Air Defence

Fig 5-6b.

PROLIFERATION OF GROUND BASED AIR DEFENSE SYSTEMS	
ZPU-2 ZPU-4 BTR-40 BTR-152	Extremely simple to operate and maintain. Cheap. Albania, Angola, Burundi, Congo, Ethiopia, Indonesia, Iran, Iraq, Kampuchea, Laos, Mali, Mongolia, Nicaragua, PLO, Somalia, Sri Lanka, Uganda, Vietnam, Zaire, Zimbabwe.
ZSU-23-4	Algeria, Angola, Cuba, Egypt, Ethiopia, India, Iran, Iraq, North Korea, Libya, Syria, PRC, Vietnam
SA-6	Analogous to the USA Hawk. Extensive service in 1973 Arab-Israeli and Iran-Iraq wars. Straight Flush radar can acquire and track to 90 km. Known operators include Chad, Algeria, Angola, Cuba, Egypt, Guinea, Ethiopia, India, Iraq, Kuwait, Libya, Somalia, Tanzania, N. Yemen, Peru, Vietnam
SA-7	This Soviet equivalent of the US Redeye has been exported to 55 nations and more than 25 insurgent groups. Combat use: Vietnam, Falklands, Nicaragua, Chad, Angola, Thailand. Its simplicity makes it a favorite of terrorists and guerrillas.
SA-8	This all-weather, low-altitude system is similar to Roland. It replaces SA-6 because of greatly improved mobility. The Syrians used them against Israel in the Bekaa Valley in 1982 The surveillance radar has a 30 km range and the tracking radar has a 25 km range. Algeria, Angola, India, Iraq, Jordan, Kuwait, Libya, & Syria are the major non-WP users.
SA-9	This low-altitude, clear-weather system was designed to complement the ZSU-23-4. Used during 1982 Bekaa Valley, Iran-Iraq, & Angola-South Africa wars. Users include Egypt, Algerian, Angola, Cuba, Iraq, Libya, Mali, Mozambique, PLO, Nicaragua, Mauritania, SWAPO, Syria, S. Yemen, & Vietnam.
SA-13	This replacement for the SA-9 provides increased mobility. Like the SA-9, it is employed in conjunction with ZSU-23-4 Combat service in Chad-Libya and Angola-South Africa wars. The Dog Ear radar has a 50 km acquisition range. Users include Algeria, Angola, Cuba, Iraq, Jordan, Libya, & Syria.
SA-14	Replaces the SA-7. Offers greater resistance to IRCM and has an all aspect kill capability. It is in service with Cuba, Angola, India, Jordan, Nicaragua, and Syria
SA-16	This new, extremely accurate missile is replacing the SA-7 & SA-14 in Soviet and WP units. Little is known about it.

Source: Jane's Land-Based Air Defence

Fig 5-6c.

PROLIFERATION OF GROUND BASED AIR DEFENSE SYSTEMS (cont)	
M-42	Post WW II US weapon. Still used by Greece, Guatemala, Jordan, Lebanon, Taiwan, Thailand, Tunisia, Turkey, Vietnam.
M-163 Vulcan	Active service with Israel, Jordan, Morocco, Portugal, Saudi Arabia, Sudan, Thailand, N. Yemen.
Blowpipe	Used by both the Argentinians and British in the Falklands conflict, and by Afghan and Nicaraguan guerrillas. Users include Afghanistan, Argentina, Chile, Ecuador, Nicaragua, Nigeria, Oman, Pakistan, and Thailand.
Crotale	A mobile, all-weather, low-altitude SAM developed by France for South Africa. It is used by Chile, Egypt, Greece, Libya, Pakistan, Saudi Arabia, and South Africa.
Roland II	A mobile, all-weather, low-altitude SAM developed by jointly by Germany & France. Combat in Falklands & Iran-Iraq. Used by Brazil, Argentina, Iraq, Nigeria, Qatar, Venezuela.
Stinger	More than 16,000 Stingers have been produced and production continues. They were used by Afghan guerrillas against the Soviets, and captured ones were fired at US forces in the Persian Gulf. Also used in Angola and Nicaragua. In use with UNITA, Bahrain, Iran, Contras, Saudi Arabia, & Bahrain.
Hawk	The Hawk has been manufactured by the thousands in Europe, Japan, & USA. Saw service in the Arab-Israeli 1967, 1973, & 1982 conflicts and the Iran-Iraq war. Excellent results against low flying fighters and helicopters. Users include Egypt, Greece, Iran, Israel, Jordan, Kuwait, & Saudi Arabia.
Redeye	Production is complete on the Redeye. Combat experience in Somalia, Sudan, Chad, and Nicaragua. Users include Israel, Greece, Jordan, Contras, Saudi Arabia, Somalia, Sudan, Thailand, and Turkey.

Source: Jane's Land-Based Air Defence

Fig 5-6d.

Prospects for the future seem heavily weighted in favor of the air defender. More and more Third World nations are equipping themselves with "high-tech" early warning systems, interceptors and air defense systems, though the

ability to employ them varies widely between countries.[36] Overall, the quantitative and qualitative threats to special operations and conventional aviation are growing tremendously.

As the Soviets develop new air-to-air helicopters and fixed wing interceptors, their older systems are being sold or given to the Third World nations seeking to strengthen their regional positions. It is expected that most countries will equip their forces with modern surface-to-air missiles and capable interceptors. One would be foolish to discount the potential capability the developing nations possess as a result of their aircraft and air defense system acquisitions.

The future does not promise any lessening in the spread of sophisticated, integrated air defenses. Avoiding detection to deny enemy targeting is becoming very difficult. As Mr Lynn Rylander, Special Assistant in the Office of the Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict noted, technological advances in air defense systems will make long-range penetration deep into enemy territory "difficult, if not impossible, propositions."[37]

Technology

Since the infancy of aviation, aerial combat has been inevitable. "On the ground and in the air, the application of

technology has increased the lethality and types of threats."[38] As technology provides an advantage to one side, the other tries to deny that superiority. The response to a technological gain usually take the form of another, corresponding system or else tactics to exploit technological weaknesses. In some cases, fielding an overwhelming number of inferior defensive systems can provide an interim solution, but in most scenarios, that equates to "cannon fodder." Any failure of friendly forces to keep pace with technological advances will result in both a qualitative and quantitiative advantage for the threat.[39]

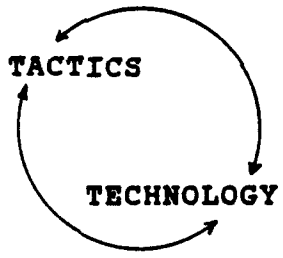


Fig 5-7.

As one studies the history of warfare one realizes the cyclical relationship between tactics and weapons technlogy, and how they affect the ascendancy of either the offense or the defense. (See Fig 5-7.) When opposing technologies equalize mobility, firepower, or survivability, then doctrine, tactics, and procedures must change in an attempt to regain superiority. Similarly, when tactics stagnate, technology

reacts to break the stalemate. As Sir Anthony Trythall noted, "All military technological developments will in time be countered, and so on ad infinitum. Asymmetry leads to opportunities and symmetry leads to stalemate."[40]

In the past, the cycle of technological or tactical change and reaction was slow enough to allow each side to react. Anticipation of future developments allows one to stay ahead of the opponent's developmental cycle.[41] The costs of developing, procuring, and fielding new equipment makes the rate of technological change for aircraft relatively slower than that for air defense systems. Anticipating the impact of technology can focus US efforts and perhaps even shorten the time it takes to develop the doctrine, tactics, training, and equipment necessary to meet the new threat.

Current Doctrine

Special operations aviation provides uniquely trained and equipped air forces to support the airlift and fire support needs of SOF ground and sea forces. Since WW II, the mobility and flexibility offered by specialized air support has often been the key to successful special operations. SOF air assets clandestinely penetrate hostile and sensitive

airspace with extraordinary precision at extended ranges under night, adverse weather conditions, to conduct and support special operations missions.[42]

This thesis only considers helicopter support to Direct Action and Special Reconnaissance, the "high end" of special operations. This is their primary function--their training and equipment are geared to successful accomplishment of these very difficult missions. The majority of the tasks prescribed for SOF helicopters supporting UW, FID, or CT are the same or similar to those in DA and SR. Unconventional Warfare and Foreign Internal Defense are usually accomplished by host nation or indigenous forces, and only on rare occasion by direct U.S. intervention.[43]

Because the emphasis in UW and FID is on training or advising others to fight their own battles, the commitment of resources by the US tends to be fairly small. The helicopter training most nations desire is better served by conventional crews. Special operations crews and helicopters can provide the general support usually required, but this detracts from their primary mission of clandestine penetration into denied areas.[44] Counterterrorist operations are a unique task, usually performed by a small, specially trained and equipped

force. On occasion, CT could be included as a specialized training function under the auspices of FID or conducted "in extremis" by normal SOF aviation units.[45]

Like their conventional counterparts, the principal threats to SOF helicopters in most scenarios are ground-based air defenses and fixed and rotary-wing interceptors.[46] SOF helicopters are most vulnerable to discovery and interception while enroute to and returning from an objective.[47] Once an insertion or extraction of a SOF ground team is made, it has been argued that there is no need for the helicopters to remain clandestine. This is false. Though the enemy may know helicopters are, or have been, operating in a region, they must not identify the intended target nor the identity of the SOF forces. The degree of threat is dependent upon the nature of the enemy, the terrain and weather, and the time limitations placed upon the mission.

> Aviation cannot survive on the battlefield unless Threat air defense target acquisition systems and weapons are located, suppressed, obscured, or destroyed.[48]

To the maximum extent possible, SOF aircrews use passive measures to avoid enemy interceptors. Clandestine penetration requires SOF helicopters to avoid detection for survivability and secrecy. "Aircrews of unarmed aircraft do not have the option of engaging enemy aircraft."[49] The best the lift helicopters can do is to initiate avoidance maneuvers in the hope of evading the threat long enough for the opponent

to quit the fight. Tactics, electronics, and onboard weapons might assist the escape, but they have decreased effectiveness against other alerted air defenders and interceptors. The ultimate goal is to avoid detection, but should that fail, it is to successfully fight their way to safety. Current SOF helicopters stand a good chance of avoiding detection given the current threat. The increasing numbers and capability of threat air defenses throughout the world is rapidly decreasing the likelihood that they could fight their way to safety

In many instances, it is possible that US forces could be asked to provide mobility or resupply to host government or surrogate forces. As the Soviets discovered in Afghanistan, the opportunities for uncontested mobility are few and far between.[50] Current US systems and tactics are adequate to counter most threat early warning and detection systems, but that advantage is diminishing rapidly. Threat interceptors are predominantly day-only, but rapidly acquiring a night capablility. The safety and security afforded by night, low-level operations currently provides sufficient protection within acceptable risk limits, but not for long.

A. Direct Action

These short-duration strikes would seize, damage, or destroy specific targets or personnel. SOF aviation missions would entail clandestine or covert penetration of hostile and

denied areas to support strike or recovery teams. In addition, special operations helicopters could conduct raids, ambushes, and air assaults deep in enemy territory.[51]

There is a significant deficiency here. Although the capabilities of target nations vary significantly according to the scenario, the measurement of success is against the most dangerous threat. Acceptable risk in the most dangerous scenarios yields excess capability and minimal risk at the low end, but it is justify the expense and development risks of the most capable systems.

Many target nations now, or soon will have the ability to defeat helicopters employing current SOF tactics and self-protection weapons and avionics. While current lift helicopters can detect and evade or defeat most current threat early warning systems, their capability against air defense missiles and interceptors is severely lacking. On-board gun systems are marginally effective against armored targets and ineffective against nearly all air threats.[52] Lift assets within a formation can combine fires for mutual support, but the slow speed and large size of the lift helicopters makes them extremely vulnerable to advanced air defenses.

Large formations of lift helicopters (more than three helicopters[53]) are easy, lucrative targets for look-down,

shoot-down missile systems and fighter-helicopters. Pulse doppler and millimeter wave radars are giving more and more fighters and some fighter-helicopters the ability to detect helicopters flying at extremely low altitudes. Terrain masking, electronic warfare, and night operations continue to provide a counter to most Third World interceptors. While many of these aircraft are not likely to be equipped with state-of-the-art radar and missile systems, one cannot discount the availability of nor prepare for their employment.

Survivability is ensured by avoiding detection--a task rapidly becoming harder to do. One key ingredient to this is weighing the relative value of additional helicopters, over and above the minimum required to conduct the lift. Each additional aircraft increases the probability of detection. It is a choice between security and secrecy, though. "Air combat will be critical in future wars. It is always a specified or implied mission when an air threat is predicted or present."[84] The commander must balance the requirement to protect the formation with the possibility of compromise. As the doctrine states, though, the probability of interception is great and increasig.

B. Special Reconnaissance

Even more so than Direct Action missions, SOF aviation support to Special Reconnaissance demands clandestine

penetration of hostile or denied airspace. Possible scenarios would include insertion, extraction, or resupply of reconnaissance ground teams in support of strategic, operational, or tactical objectives, initial contact with indigenous resistance organizations, and poststrike assessment of theater deep attack weapons.[55] In addition, SOF helicopters could conduct reconnaissance and surveillance by themselves, although instances of this would be rare.[56]

There is also a significant deficiency here and a requirement for reasonable success against a fairly difficult threat. The special reconnaissance mission requires ground teams look at targets but avoid contact with enemy forces. Much more so than in Direct Action, success is measured in terms of avoiding detection. This is true during all phases of the operation, but especially during the infiltration and execution phases. During the extraction phase, the requirement for secrecy lessens, although the amount may be negligible. In many scenarios, if the enemy knows the reconnaissance took place, he can move or prepare before friendly forces can exploit the information. While lift helicopters supporting the surveillance teams can detect and evade or defeat most threat early warning systems, their ability to use active electronic combat and self-defense

weapons is impeded by the requirement to remain unobserved. Once active countermeasures are employed by the SOF helicopters, the enemy is able to detect and target them.

Tactics and avionics are suitable for present detection systems. Should the airlift formation be discovered, however, it would be ill prepared to defend itself. In most scenarios, the threat has significant intercept capability. Current SOF lift assets are unable to fight their way out of most compromised situations. Even more so than Direct Action missions, the mission would likely be aborted should the infiltration be compromised.

C. Role of Armed Escort

Escort aircraft are assigned to protect other aircraft during a mission. Escort aircraft may be tasked to defend aircraft conducting airlift, airmobile, combat rescue, and other missions.[87] Planning for deep strikes, extractions, or insertions, whether conventional or special operations, must include use of escort aircraft to counter enemy air attacks and to suppress ground-based air defenses. "Regardless of armed aircraft availability, unarmed aircraft must be escorted by attack aircraft during deep operations."[88] The organic protection systems of the transport helicopters are not intended to suppress enemy air defenses nor engage enemy interceptors.

Because SOF aviation intentionally operates well beyond the range of friendly air defense coverage, they are more likely to encounter enemy tactical air assets. "When this occurs, aircrews may have to engage enemy aircraft in aerial combat to protect themselves."[59] With SEAD and air-to-air capability limited by organic systems and aircraft perfomance, the lift helicopters cannot protect themselves and have to rely on evading the threat if possible. During deep operations, aircraft will normally avoid aerial combat. Aviation commanders, however, must allocate forces to counter the air threat when planning deep operations.[60]

The primary mission of escorting aircraft would be to provide the security force. Typical missions would include enroute security, suppress enemy air defenses enroute and during the infiltration and extraction, and route reconnaissance.[61] Although a covering force would be important during some missions, the relative value would have to be weighed against the risks involved by possible loss of secrecy and increased likelihood of detection. Because the force is most vulnerable to interception while enroute, the lift formation's major needs are SEAD, air-to-air protection, and reconnaissance during the critical enroute phase. Except for rare occasions (such as Mayaguez or the British Special Air Service attack on the Argentine early warning radar),

there is no need nor intent for forcible entry. In a few scenarios, it might be necessary to provide preparatory and suppressive fires at the objective, but these would be the exception vice the rule.

To accomplish the security and reconnaissance missions, escorts would utilize traveling, traveling overwatch, and bounding overwatch techniques (Figs 5-9a, 5-9b, 5-9c), depending upon the likelihood of enemy contact while flying to or from the objective. The security force must be aggressive and sufficiently removed from the main body to provide reaction time and air maneuver space.[62] Remembering that the primary goal during most Direct Action and virtually all Special Reconnaissance support missions is clandestine insertion, the security elements have to balance the threat to the lift formation with possible compromise. Keeping distance between the escort forces and the lift elements serves the dual purpose of helping to protect the main body from detection by diverting attention away from the transports and giving the escorts enough room to maneuver and engage the enemy. "If ordered to avoid detection and engagement . . . , the security element will mask and continue to report to the assault force commander."[63] This allows the lift elements to maneuver to also avoid detection. In each of these situations, the coordination and communication requirements are necessarily significant.

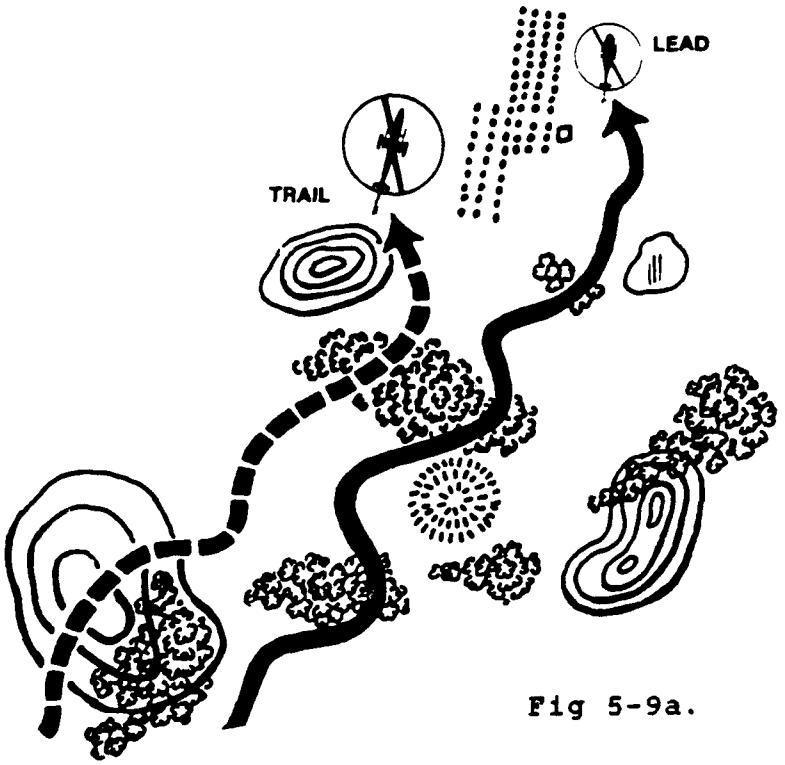


Fig 5-9a.

TRAVELING

1. BOTH AIRCRAFT MOVE SIMULTANEOUSLY AND CONTINUOUSLY
2. AIRCRAFT FLY AT CONSTANT ALTITUDE
3. AIRCRAFT MOVE AT A CONSTANT RATE OF SPEED

Fig 5-9b.

TRAVELING OVERWATCH

1. LEAD AIRCRAFT MOVES CONTINUOUSLY AT NOE ALTITUDES
2. TRAIL AIRCRAFT MOVES AS NECESSARY TO OVERWATCH LEAD AIRCRAFT

BOUNDING OVERWATCH

1. BOTH AIRCRAFT FLY AT NOE ALTITUDE
2. BOTH AIRCRAFT MOVE SLOWLY
3. ONLY ONE AIRCRAFT MOVES AT A TIME
   - LEAD AIRCRAFT MOVES FORWARD UNDER PROTECTION OF TRAIL AIRCRAFT
   - LEAD STOPS AND TRAIL BOUNDS FORWARD TO NEW OVERWATCH POSITION
   - LEAD MOVES FORWARD AGAIN

Fig 5-9c.

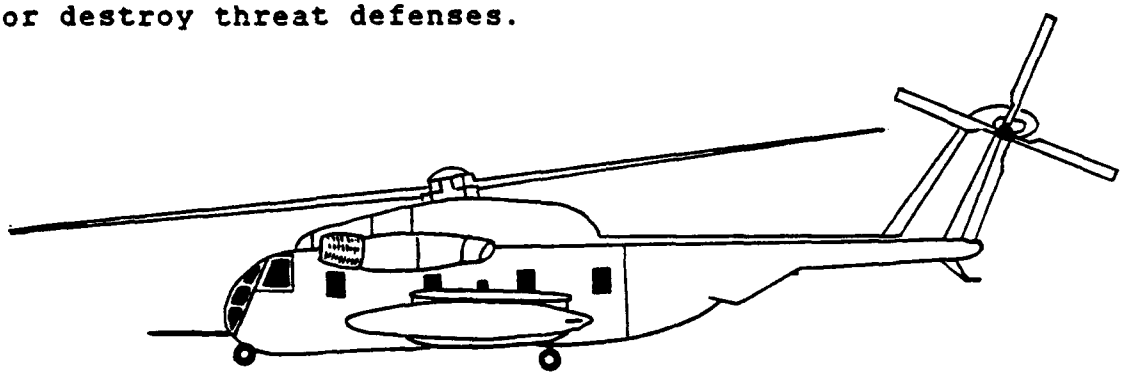
During all missions, the escorting aircraft must be able to protect the lift helicopters from the enemy air-to-air threat, discover enemy air defense threats prior to them detecting the formation, destroy or disrupt enemy acquisition and targeting systems if avoidance is not possible, provide terminal guidance to precision munitions, and if required provide aerial fire support to SOF ground teams.** During Special Reconnaissance, though, crews take extra care to plan missions to avoid detection and prevent mission compromise. Although each of the above tasks can be performed during SR, every precaution is taken to remain clandestine or covert.**

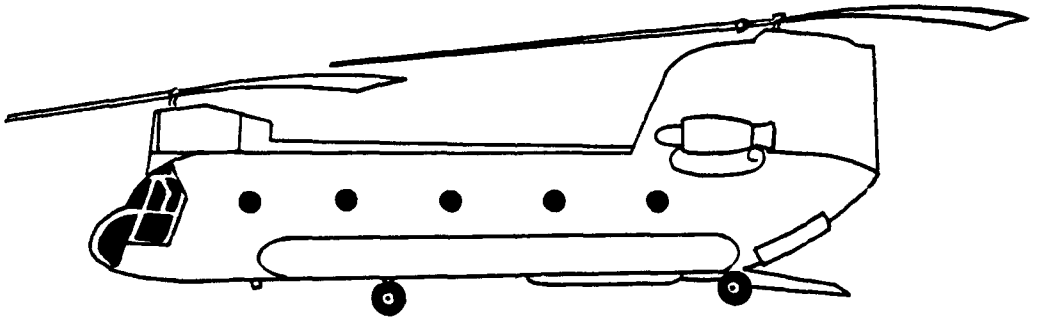
Air-to-air combat and suppression of enemy air defenses during deep penetrations will result from the need to protect the lift elements and the ground forces during deep strikes and clandestine insertions or extractions. In the interests of mission success, though, it is often more advantageous to avoid the enemy and evade detection. Because it is becoming more likely that SOF deep penetration forces will be detected, targeted, and intercepted, air-to-air combat and SEAD must be planned for.[66] Armed helicopters employed in an escort role are extremely effective due to their flexibility and ability to deliver ordnance.[67] Air cavalry and attack helicopter units can provide security and route reconnaissance to conventional air assault units conducting deep strikes.[68] Their training and equipment are usually inappropriate for special air operations, though.

Friendly Capability

The two primary special operations lift helicopters are the Army's CH-47D (soon to be replaced with the MH-47E) and the Air Force's MH-53J. These aircraft typically have 2½ to 4½ hours of unrefueled endurance at 100 to 140 knots cruise, depending on mission requirements. Mission profiles require them to have an operating radius greater than 200 nm from departure point. Because both can be refueled inflight from C-130 tankers, their range is virtually unlimited. Both are capable of penetrating long distances at night, in adverse

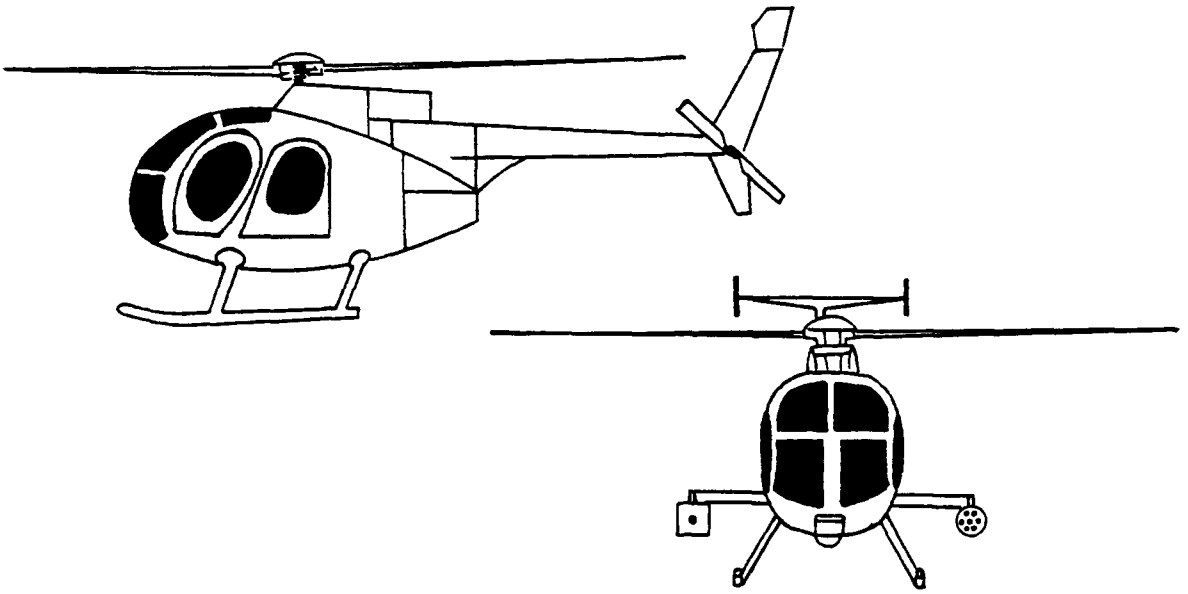
weather at very low altitudes, and are equipped with extraordinary electronic warfare suites. Based upon the historical perspective and the expected tactics, any escort aircraft must possess compatible performance, especially in range, endurance, electronic warfare, and night vision systems. Speed, agility, and firepower must be sufficiently better to allow the escorts to successfully defeat, disrupt, or destroy threat defenses.





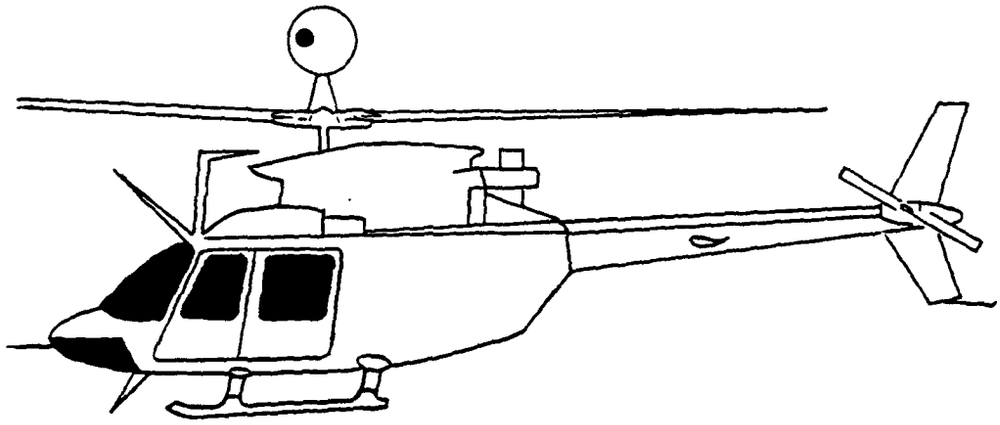
There are a variety of aircraft currently available from within the present inventory that could perform armed escort for the primary SOF lift helicopters. Because of disparities in speed, range (to include inflight refueling), and avionics, none is the perfect solution to counter the

burgeoning threat. Some might be modified to accomodate the performance and mission threat requirements.



Hughes MH-6

The MH-6 is an extremely capable helicopter in certain situations. It is air transportable by C-130 and C-141. It is not self-deployable except by a series of 200 nm legs. This limits its ability to perform the deep penetration missions envisioned by this study. Furthermore, although the MH-6 has 7.62 or .50 caliber machine guns, neither are effective air-to-air weapons. The Forward Looking Infrared Radar (FLIR), when combined with pilot's night vision goggles, provides a good night flying and fighting capability. Lastly, the MH-6 suffers from a lack of electronic warfare systems, specifically no Radar Warning Reciever or IR jammer.

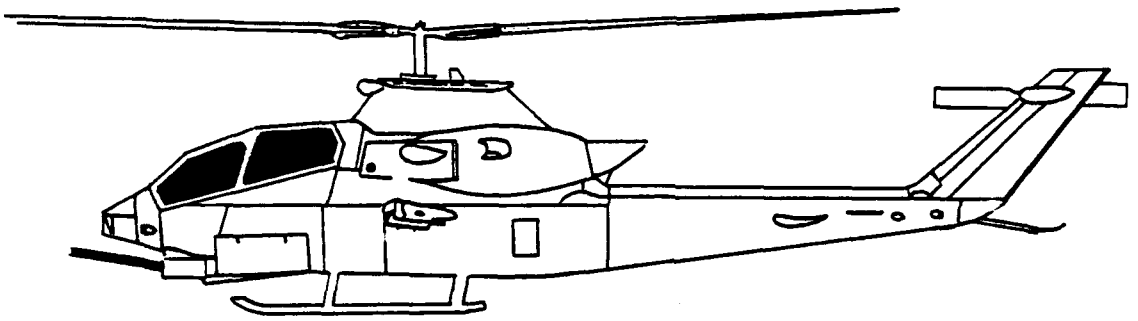


Bell OH-58D

The OH-58D is an exceptional aircraft with enviable combat service in the Persian Gulf and Panama. It has proven itself to be a reliable performer, overcoming all the performance problems of earlier models. The OH-58D is capable of firing the air-to-air Stinger, Hydra 70 rockets, and could be fitted with 7.62 or .50 caliber machine guns. It was designed and procured for the Army as part of the Apache/Scout team to defeat the Soviet armor threat.

There are two major problems with the OH-58D fulfilling the armed escort role for SOF. The primary one is that there are not enough to go around. Since proving itself during combat in the Persian Gulf, other Services and branches are asking for the use of these limited resources. With the declining budgets looming on the horizon, it is doubtful that more D-models will be bought in order to let everyone who

wants them have some. The other problem is with range. Unless the OH-58Ds refuel at a forward arming and refuel point (FARP), they do not have the range to escort the lift elements to the landing zones, loiter while the lift helicopters deposit their ground teams, and then fly home. This is analogous to the problem faced by 8th Air Force fighters in Europe trying to protect the B-17s all the way to Germany and back.

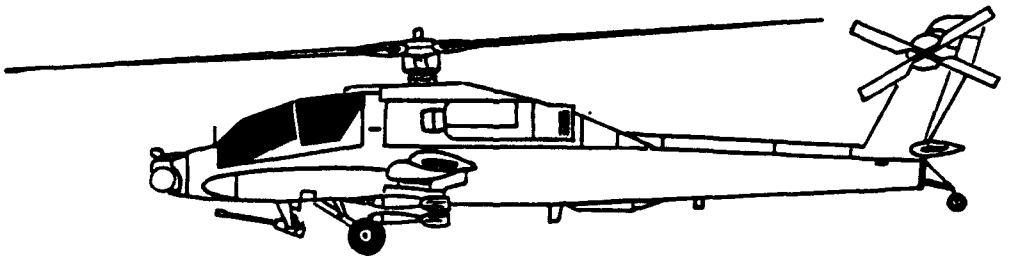


Bell AH-1S

The AH-1S is a very capable aircraft with a long history of armed escort of conventional forces. There has been some local cross training with SOF units, to test the concept of AH-1s providing armed escort during long range penetrations, although this has been kept at a local level. The night vision capability is acceptable for most

special air operations. The Cobra's speed is slow enough to stay with the lift elements, yet fast enough to be effective in an air-to-air or SEAD fight.

Like the OH-58D, the problem is range. The Cobra has to refuel at a FARP because it is not air refuelable as are the current lift helicopters in both the Army and the Air Force. It is significantly constrained during missions over 100nm from its departure point. The weapons and electronic warfare capability is adequate for most ground threats. The M197 is a 20 mm Gatling gun designed to hit stationary or slow-moving armored vehicles.[6] The 750 rounds per minute (rpm) rate of fire is inadequate for most air-to-air engagements. Guns in fixed-wing interceptors generally fire around 7,000 rpm.[7] The Cobra is not equipped with an air-to-air gunsight. Lastly, although it is possible to install the system, the AH-1S does not have, nor are there plans to equip the Cobra with the air-to-air Stinger.



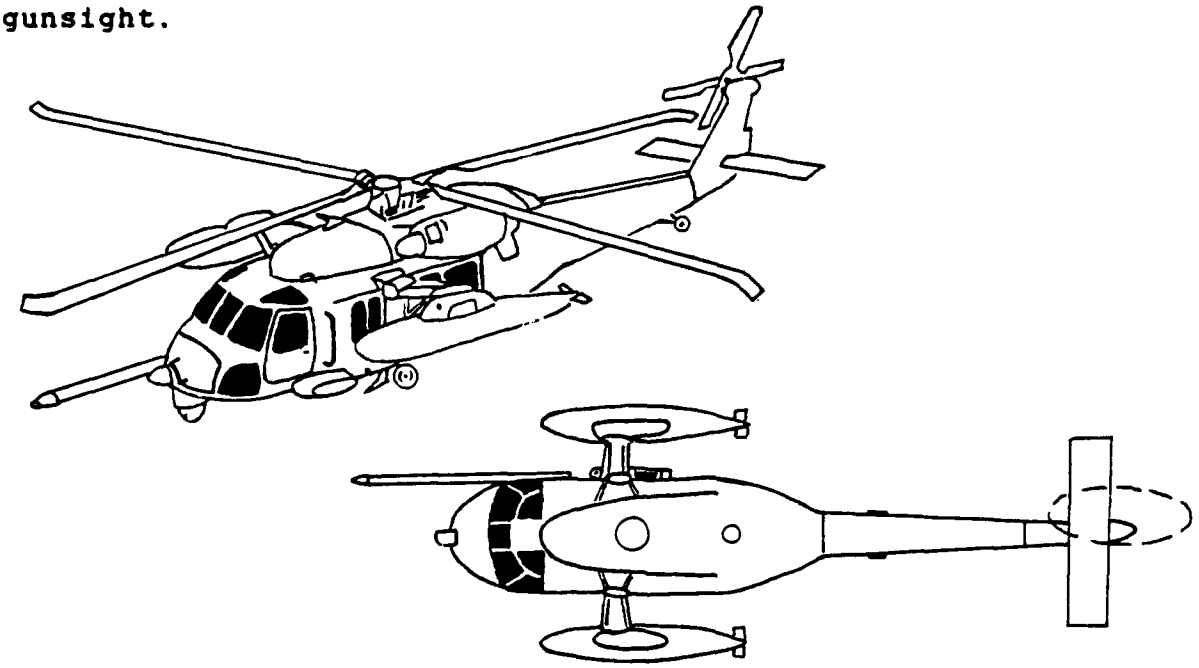
Hughes AH-64

This is the premier helicopter gunship in the free world. The Apache is an extremely capable night fighter; designed and procured to kill Soviet tanks in a general war scenario. Its major drawback is that in conventional war plans, the AH-64s are heavily tasked to support the main effort and is key to Army plans to conduct the deep battle. It is unlikely that many would be available tc support special air missions--unless the Joint Force Commander deemed it more important to divert these precious resources away from the main battle and their primary antiarmor role.

Like the previously mentioned helicopters, the AH-64 also suffers from range problems. It, too, must land to refuel at a FARP in order to conduct missions more than 100 nm from its departure point. This significantly increases chances for mission compromise. The AH-64 has an impressive electronic warfare suite. Plans are being made to equip the Apache with the air-to-air Stinger.

The M230 Chain Gun in the nose of the AH-64 is a 30 mm cannon designed to kill tanks. Its 625 rpm rate of fire is slower than the M197 system found in the Cobra, but adequate for the antiarmor mission. Tests are being conducted and work is in progress to improve the air-to-air capability of the M230, but nothing is expected in the near future.[74]

Like the Cobra, the Apache does not have an air-to-air gunsight.

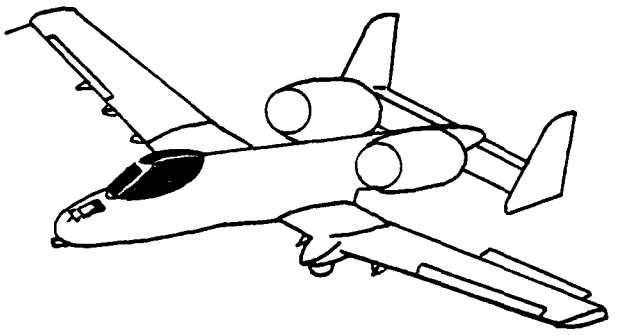


Sikorsky MH-60G/K

Although designed as a lift aircraft to complement the MH-47E and the MH-53J for both the Army and the Air Force, many of the features built into the MH-60 make it a promising candidate to fulfill the armed escort role. Its performance is compatible, in speed, range, and night vision capability, with the both of the primary lift helicopters. Its electronic warfare sytems are state-ofthe-art, with capability for expansion built in.

The major drawback to the MH-60 is firepower. The standard GAU-2B minigun and XM-218 .50 caliber machine guns are not air-to-air weapons. They are side firing weapons, designed for area suppression at a landing zone. Furthermore,

without TOW or Hellfire missiles, the MH-60 using these weapons would be hard pressed to suppress enemy air defenses from acceptable standoff ranges. The MH-60 does have the hard points and wiring to accept the External Stores Support System, though. This gives the MH-60 the ability to carry and fire Hellfire or Stinger missles and the 20 mm gun pod.



Fairchild A-10

The A-10 was procured by the Air Force to fulfill Army close air support needs after the Vietnam War. It is the only airplane considered by this study. The heart of the A-10 is its tank-killing GAU-8 30 mm gun. In its present configuration, the GAU-8 is not an air-to-air weapon. There is currently a modification being made to the A-10 fleet to incorporate an air-to-air gunsight. The questionable nature of the Air Force budget might cause this program to be stretched out or cancelled althogether. Over the course of its lifespan, the A-10 has been upgraded to accept the AIM-9L air-to-air missile. This was intended to increase its survivability in a conventional war scenario, but has excellent utility during

an armed escort mission. With the GAU-8 and the Maverick IR or TV guided missiles, the A-10 can kill tanks or suppress enemy air defenses. The latter mission, however, is not the optimum use for this airplane in most scenarios.

The major drawback to the A-10 is that because of its high relative speed and its lack of night vision systems, the A-10 is not capable of flying at very low altitudes, at night, like the MH-47 and the MH-53. An airplane flying overhead the lift element negates all clandestine aspects of the mission. During a forced entry, such as the combat rescues of the Vietnam era, the A-10 would be an excellent escort, though, especially with its air-to-air missiles. One minor point, and one easily overcome, is that the inflight refueling system of the A-10 will not work with the C-130 tankers used by the helicopters.

Review

There are a variety of options to consider when designing an armed escort for SOF helicopters. (See Fig 5-10.) The primary consideration is the ability to remain undetected while still providing adequate protection to the lift formation. Secondly, as a minimum, the speed, range, and night vision systems must be compatible between the

escorts and the lift element. Lastly, the escorts must be capable of defeating present and future ground-based air defenses and air-to-air threats.

While each of the above aircraft meets many of the criteria, none are optimum. (See Fig 5-11.) With the expected budget cuts looming on the horizon, it is unlikely that a new aircraft, maximized to provide clandestine escort, is an option. Planners and tacticians need to look at adapting present systems to fulfill the armed escort role in the near term, and while continuing the quest for a specifically designed platform in the future.

ESCORT AIRCRAFT CAPABILITY

	SPEED V_{ne} Cruise	RANGE (max)	ENDURANCE	AVIONICS/ SYSTEMS	WEAPONS
Hughes MH-6A	130 kts	180 nm	2+00	FLIR M-130	7.62 or .50 cal
Bell OH-58D	130 kts 110 kts	300 nm	2+30	NVG cockpit	Stinger .50 cal Hydra 70
Bell AH-1S	170 kts 123 kts	274 nm	1+50	NVG cockpit ALQ-144 APR-39 AAS-32 IR suppressor	M197 Hydra 70 TOW
Hughes AH-64	197 kts 160 kts	260 nm	1+50	ALQ-144 APR-39, TADS ALQ-136 AVR-2, AAQ-11	M230 Hellfire Hydra 70
Sikorsky MH-60G/K	192 kts 160 kts	880 nm	4+50	AAQ-16, ALQ-144 APR-39, AVR-2 M-130, AAR-47 APQ-172 (K) ALQ-136	GAU-2B XM-218
Fairchild A-10	350 kts 280 kts	800 nm	2+30	ALE-69 ALQ-131 ALE-40 Pave Penny	GAU-8 AIM-9L Maverick Rockeye 500 & 2000 lb bombs

AAQ-11: Pilot's Night Vision Sensor
APR-39: Radar Warning Receiver
ALQ-144: Infrared Jammer
AAS-32: Laser Rangefinder
AVR-2: Laser Warning Receiver
AAQ-16: Forward Looking IR Radar
ALQ-136: Radar Jammer
APQ-172: Multimode TF/TA Radar
ALE-69: Radar Warning Reciever
ALE-40: Flare & Chaff Dispenser
ALQ-131: Radar Jammer
TADS: Target Acquisition and Designation System
GAU-2B: 7.62 Gatling Gun
XM-218: .50 cal machine guns
M197: 20 mm machine gun
GAU-8: 30 mm Cannon
Hydra 70: 70 mm rockets
Maverick: Air-to-ground missiles
AIM-9L: Sidewinder missile
Rockeye: Cluster bombs
Pave Penny: Laser Detector
M230: 30 mm Chain Gun

Source: Jane's All The World's Aircraft[72]

Fig 5-10.

	COMPATIBILITY	ADVANTAGES	DISADVANTAGES
MH-6	Night vision systems (NVGs & FLIR), cruise airspeed.	Currently used by Army SOF, very agile, can be modified to fly without a tail rotor.	Short range, no air refueling, no air-to-air weapons, no speed differential.
OH-58D	Night vision (NVGs), cruise airspeed.	Air-to-air msl, very agile, SEAD avionics.	Short range, no air refueling, no speed differential, prime role is antiarmor.
AH-1S	Night vision (NVGs), defensive avionics, cruise airspeed.	Agile, can be fitted with air-to-air missile, SEAD avionics & weapons, slight speed difference.	Short range, no air refueling, older system, weapons optimized for antiarmor role.
AH-64	Night vision systems (NVGs & FLIR), defensive avionics, cruise airspeed.	Very agile, wired for air-to-air missiles, good speed difference, SEAD avionics & weapons.	Short range, no air refueling, scarce resource, weapons optimized for antiarmor role.
MH-60G/K	Night vision systems (NVGs, FLIR, TF/TA radar (K only)), cruise airspeed, air refueling, range, unrefueled endurance defensive avionics.	Agile, can be fitted with air-to-air or SEAD weapons, good speed difference.	Larger than other helicopters listed, originally intended as lift platform, no SEAD avionics or weapons.
A-10		Extremely agile, equipped with SEAD & air-to-air weapons, great speed difference.	No night vision capability, too fast to stay with lift helos, unable to fly low-level at night, endurance is too short.

Fig 5-11.

Summary

The present capability to successfully conduct Direct Action and Special Reconnaissance missions is satisfactory, but it is fading fast. Technology is rapidly shifting the offensive advantage in special operations to the defense.

The assumptions made about future wars after World War II were mistaken. Because the Army and the Air Force prepared for a major confrontation with the Soviet Union, they were caught off guard for the two conventional wars they fought against Korea and Vietnam. Not only did the nature of the war(s) prove different from the one anticipated, but the technology took a turn away from the offense to favor the defense.[73] Throughout, special operations helicopters continued to employ their special night, low-level tactics to maintain their offensive flexibility and initiative.

Until recently, the preferred special operations tactic was to avoid enemy defenses by flying outside or under effective radar coverage. That option is fading fast. As the threat improves its detection and targeting abilities and capable air defense systems proliferate throughout the world, the ability to penetrate hostile or denied airspace will become more and more difficult.

The doctrine is quite clear that transport helicopters require protection from enemy interceptors and air defenses. It is well established for deep operations concerning conventional air assault missions and air force assets striking enemy interdiction targets and second echelon forces. Within special operations aviation, this escort doctrine only applied during those Direct Action missions intending forced entry. It is rapidly becoming a requirement for nearly all deep penetrations. The tide in special air operations is shifting to the defense. Unless existing aircraft and systems adapt to counter the near-term threat, special operations helicopters will likely lose their technological and tactical advantage. Because most special operations are fraught with high risk and significant political liability, the repercussions of a failed mission could be disastrous to the national prestige.

[1]Stephen Coonts, The Minotaur (New York: Doubleday, 1989), p 43.

[2]John O. Marsh, Jr. "Comments on Low-intensity Conflict," Military Review, Vol 69, No 2 (February 1989), p 2.

[3]FM 1-100, Doctrinal Principles for Army Aviation in Combat Operations (Washington DC: Hq Department of the Army, 1989), p 1-13. One might add a second curve to the graph, mirroring the first, showing the risk to national survival at differing levels of conflict. LIC constitutes a lesser threat to the nation than does strategic nuclear war.

[4]Department of the Army, Joint Low-Intensity Conflict Project Final Report, Vol 1, Analytical Review of Low-Intensity Conflict (Ft Monroe, VA: US Army Training and Doctrine Command, 1986), p 2-5.

[5]Bradley L. Butler, Planning Considerations for the Combat Employment of Air Power in Peacetime Contingency Operations (Langley AFB, VA: Army-Air Force Center for Low Intensity Conflict, 1988), p 2.

[6]LtGen Wallace H. Nutting, "Nutting: Stand Fast," Newsweek, Vol 101, No 24 (6 June 1983), p 24.

[7]Dr Richard P. Hallion, "Doctrine, Technology, and Air Warfare," Airpower Journal, Vol 1, No 2 (Fall 1987), p 22-23.

[8]Dr Richard H. Schultz, Jr, "Low-Intensity Conflict and US Policy: Regional Threats, Soviet Involvement, and the American Response," in Low-Intensity Conflict and Modern Technology, ed. Lt Col David J. Dean (Maxwell AFB, AL: Air University Press, 1986), p 77.

[9]JCS Publication 3-07, Doctrine for Joint Operations in Low Intensity Conflict (Initial Draft) (Washington, DC: The Joint Chiefs of Staff, 1989), p V-15.

[10]JCS Publication 3-07, p I-1.

[11]AFM 2-20/FM 100-20, Military Operations in Low-Intensity Conflict (Washington, DC: Hq Department of the Air Force, Hq Department of the Army, 1989), p vi. This document is jointly published by the Army and the Air Force. It is designed to fill a void in each of their doctrines for LIC. It also emphasizes Service efforts to jointly address the issue.

[12]Kenneth M. Page, "US Air Force Special Operations: Charting a Course for the Future," Airpower Journal, Vol I, No 2 (Fall 1987), p 58.

[13]AFM 2-20/FM 100-20, p 1-5.

[14]William J. Olson, "Low-intensity Conflict: The Institutional Challenge," Military Review, Vol 69, No 2, (February 1989), p 8.

[15]Joint Low-Intensity Conflict Final Report, Executive Summary, p 1.

[16]JCS Publication 3-07, p I-2.

[17]National Security Strategy of the United States, The White House (January 1988), p 35.

[18]JCS Publication 3-07, p I-21.

[19]William J. Olson, "Organizational Requirements for LIC," Military Review, Vol 68, No 1 (January 1988), p 15.

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[21]"Stinger in Afghanistan: The Soviets Try to Adapt," Rotor and Wing International, Vol 24, No 2, (February 1990), p 56.

[22]Kenneth P. Werrell, Archie, Flak, AAA, and SAM: A Short Operational History of Ground-Based Air Defense (Maxwell AFB, AL: Air University Press, 1988), p 181.

[23]JCS Publication 3-07, p I-3.

[24]Soviet Aerospace Almanac", Air Force, Vol 73, No 3 (March 1990), p 68.

[25]Joint Low-Intensity Conflict Project Final Report, p 2-3.

[26]FM 44-100, US Army Air Defense Operations, (Washington, DC: Hq Department of the Army, 1988), p 2-8.

[27]TC 1-107, Air Combat Operations (Coordinating Draft) (Ft Rucker, AL: US Army Aviation Center, 1988) p 2-2.

[28]FM 1-100, p 1-19.

[29]FM 1-100, p 1-19.

[30]FM 44-100, 4-10.

[31]FM 44-100, p 4-11.

[32]FM 100-2-1, The Soviet Army: Operations and Tactics (Washington, DC: Hq Department of the Army, 1984), p 11-12.

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[35]Jane's Land-Based Air Defence, 1989-1990, ed. Tony Cullen and Christopher Foss (Surrey, UK: Jane's Information Group, Ltd, 1989)

[36]Zakheim, p 315.

[37]R. Lynn Rylander, "Special Operations Forces After the Rise," Military Review, Vol 69, No 2 (February 1989), p 88.

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[39]FM 44-100, p 2-3.

[40]Brig Gen Anthony J. Trythall, from a debate Gen Trythall participated in concerning the legacy of Maj Gen J.F.C. Fuller, sponsored by The Royal United Services Institute, 12 Oct 78. Published in The Journal of the Royal United Services Institute, Vol 124 (March 1979), p 22.

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[42]FM 100-25, Doctrine for Army Special Operations Forces, (Preliminary Draft) (Washington, DC: Hq Department of the Army, 1989), p 9-1.

[43]JCS Publication 3-05, p II-12.

[44]FM 100-25, p 9-2.

[45]JCS Publication 3-05, p II-19.

[46]FM 100-25, p 9-13.

[47]US Army Interim Operational Concept for Special Operations Aviation, (Ft Bragg, NC: US Army John F. Kennedy Special Warfare Center and School, 1989), p 3.

[48]FM 1-100, p 1-17.

[49]FM 1-107, Air-to-Air Combat (Washington, DC: Hq Department of the Army, 1984), p 3.

[50]R&WI, p 58.

[51]JCS Publication 3-05, p II-7,8.

[52]Frank Colucci, "Guns of the Fighter Helicopter," Defence Helicopter World, Vol 8, No 4, (Aug-Sep 1989), p 43.

[53]Military Airlift Command Regulation 55-54, Helicopter Operations (Scott AFB, IL: Hq Military Airlift Command, 1986), p 71. "The primary purposes of formation flight are mutual support and control. If more than three aircraft are required for a tactical situation, consideration should be given to breaking into smaller elements to aid threat avoidance."

[54]FM 1-100, p 3-10.

[55]FM 31-20, Doctrine for Special Forces Operations, (Approved Final Draft) (Washington, DC: Hq Department of the Army, 1989), p 12-1, 12-2.

[56]JCS Publication 3-05, p II-10.

[57]JCS Publication 26, p VI-2.

[58]FM 1-107, p 4.

[59]FM 1-107, p 3.

[60]FM 1-100, p 2-24.

[61]FM 90-4, Air Assault Operations (Washington, DC: Hq Department of the Army, 1987), p 2-6.

[62]TC 1-107, p 4-38.

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[64]US Army Interim Operational Concept for Special Operations Aviation, p 16-17.

[65]AFM 2-10, Aerospace Operational Doctrine for Special Operations (Initial Draft) (Washington, DC: Hq Department of the Air Force, 1990), p 3-2.

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[69]Colucci, p 43.

[70]Colucci, p 45.

[71]Colucci, p 44.

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[73]Werrell, p 182.

CHAPTER VI

CONCLUSION & RECOMMENDATIONS

Introduction

The primary threats to special operations helicopters conducting clandestine penetration of hostile or denied airspace are ground-based air defense systems, fixed and rotary wing interceptors, and electronic detection (early warning) systems. As the number of highly capable weapon systems spreads throughout the developing nations of the world, the threat is increasing quantitatively and qualitatively for most possible scenarios.

Because most special operations rely in clandestine infiltration and exfiltration, if the mission is compromised there are few opportunities for another attempt. In contrast to conventional air assaults, most special air missions cannot try again later with greater force and firepower.[1] Because the nature of SOF missions are fraught with political risk, there is an extreme amount of pressure from the National Command Authority to do it right the first time.

The changing nature of the threat to special air operations has, and will continue to reduce the freedom afforded by night, low-level operations. The proliferation of extremely capable air defenses has increased the likelihood that SOF helicopters attempting clandestine penetrations will be detected and targeted. There is a need for dedicated security elements to protect the lift elements should the mission be compromised and the helicopters engaged by ground-based or air-to-air defensive systems.

> On the ground and in the air, the application of technology has increased the lethality, survivability, and types of threats. These modern capabilities . . . are available to all nations.[2]

The threat most often faced by special air operations will likely be a variation of the Soviet doctrine, tactics, and equipment. Potential adversaries include regional powers and Soviet surrogates. These opponents often have air and ground forces trained, equipped, and willing to execute a version of Soviet doctrine. Because of this, SOF helicopters can expect to face capable and sophisticated air threats, across the spectrum of conflict, in any region of the world.

Air defense is essentially a two step execution process--detection and targeting. Before the spread of capable electronic detection systems, SOF helicopters avoided detection and thereby made targeting nearly impossible for the defenders. Clandestine operations ensured survivability. If

discovered, the low-level tactics they employed would usually allow the SOF helicopters to break the contact. If the defenders launched interceptors, those same tactics were usually sufficient to negate or significantly degrade enemy attempts to shoot down the SOF helicopters.

Threat forces can now detect special air operations to a greater degree than ever before. In addition, they are also able to field ground-based air defense systems in great enough quantity and interceptors sophisticated enough to effectively target SOF helicopters penetrating their airspace. The problem is no longer just evading detection and thereby negating enemy chances of targeting. In case of compromise, it is likely that SOF helicopters would have to fight their way out of an aborted mission.

Conclusion

The current special operations primary lift helicopters, the Army's MH-47 and the Air Force's MH-53, would be hard pressed to escape detection or to survive against determined enemy defenders in some scenarios. These large, heavy helicopters are optimized for range, stealth, and lift capability. Their defensive avionics are designed to avoid air defenses, not defeat them. Neither has an air-to-air defensive weapon nor an air-to-ground weapon able to suppress ground-based air defenses. Although defensive weapons such as

Stinger missiles might benefit the lift helicopters, they are not agile enough to compete in the air-to-air arena. More importantly, though, with a full load of troops in the cabin, air-to-air combat is usually the tactic of last resort.

This leads one to conclude that the lift element in a special air operation requires some form of security element to protect the formation in the event of discovery. There are sufficient examples throughout the history of air combat which demonstrate the problems of aircraft optimized for one mission (e.g. strategic bombers) being decimated by sophisticated and determined air defenders. SOF helicopters are quickly reaching the point when their advantages in night vision and terrain flight capability will disappear. With that loss of technological advantage will go their offensive initiative and flexibility. The dilemma for SOF aviation, then, is to provide adequate security for the lift elements while balancing the necessity for clandestine operations.

An Operational Concept

For the near term, and possibly as a permanent solution, it appears that some form of armed escort is required to protect special operations helicopters conducting long-range penetrations into hostile airspace. The defensive systems, both ground based and airborne, facing SOF aviation have increased in quality and in such great quantity that

stealthy tactics alone can no longer ensure survivability. Armed escorts would support the ability of the lift element to disengage from a fight after detection. They would also conduct advance and rear guard actions after discovery to ensure the lift element returns to safety.

Any armed escort must be compatible in range, night vision capability, endurance, and electronic warfare with the lift helicopters. In addition, to maintain the level of stealth necessary to conduct clandestine penetrations, escort aircraft should be as capable of extremely low-level flight at night and in adverse weather as the lift element. Escorts must also possess enough firepower to destroy or disrupt ground-based air defenses, and be sufficiently agile and fast enough to defeat both fixed and rotary wing interceptors.

Based upon the Operational Concept, there are various aircraft within the present inventory that can meet many of the requirements to protect SOF lift helicopters during deep penetrations. None, however, meet all possible performance criteria. As in the historical examples cited, disparities in range, speed, and endurance negate the effectiveness of even the best candidates in some situations.

During most Direct Action and Special Reconnaissance scenarios, SOF aviation will have to depend upon organic

assets for protection and security. In order to maintain operational security, high performance fighters would have to remain well displaced from the formation. Because of this, unless it were a forced entry profile, they would most likely be too far removed to respond in time to affect the fight.

Current defensive weapons installed on the lift helicopters are adequate to suppress any small arms or lightly armored threats. Night vision, terrain following, and electronic warfare systems are adequate to avoid most current enemy detection and targeting systems. For the most difficult direct action and special reconnaissance profiles, and future missions in what are currently marginal scenarios, special operations helicopters would be hard pressed to defend themselves should the mission be compromised.

The escort must be agile enough to successfully engage threat interceptors, both fixed and rotary wing. In addition, it should be equipped with a proven, short-range air-to-air missile, such as the Stinger or the Sidewinder. For close-in engagements, the escort must have an air-to-air gun system with a computing gunsight. Because the escort is also responsible for SEAD, it must be capable of carrying and firing an effective air-to-ground weapon such as Hellfire, TOW, or Maverick. The appropriate mix of air-to-ground and air-to-air weapons is left for further study.

Depending on the mission and aircraft configuration, the MH-47 and the MH-53 will have between 2½ and 4½ hours of endurance at 100 to 140 knots cruise airspeed. Because these two lift helicopters are can refuel inflight, there endurance is basically limited only by crew fatigue. In addition to night vision systems, any escort must also be capable of flying at the same low altitudes as the lift helicopters, in similar weather and illumination. Force structure planners and combat developers should initially look at modifying one of the aircraft currently in the inventory to make it compatible with the MH-47 and the MH-53 and capable of performing the escort mission.

The vision for the future should be looking at alternatives to the interim modified aircraft. It should be towards one designed for and dedicated to the helicopter counterair and SEAD role. This is obviously a long term solution to the problem and the most difficult to achieve, but it must be addressed now if it is to be fielded within the next ten years. "Anticipation of future developments enables us to stay ahead of the threat's development cycle."[3]

Other Considerations

The Concept Based Requirements System requires that one consider all alternatives prior to initiating an equipment

solution. One should consider doctrinal, training, organizational, and leadership development changes before opting for a new or modified weapon system. This process is conducted in large measure during Phases Two and Three, Identify Needs and Identify Solutions. As was shown in Chapter Three, there is some overlap, though. Within the framework of Phase One, therefore, this thesis will begin to examine other alternatives.

One proposal which could be accommodated rather quickly might be to change the doctrine (which includes both field manuals and tactics manuals) concerning special air operations for helicopters. It must address escort tactics and procedures unique to the SOF environment, to include air-to-air combat and suppression of enemy air defenses. The current procedures are outdated and do not reflect the current or projected air defense capabilities of many likely adversaries. Granted, this will probably generate requirements for flight testing and affect aircrew training, but the effort is more than justified by increased survivability.

Aircrew training should reflect the increased likelihood of an air-to-air or SEAD engagement in a SOF environment. Training programs for conventional aircrews are available, but they do not address the peculiar requirements

of special operations. As new tactics are developed and validated, training programs must be developed to implement the new tactics. While innovative tactics can degrade or negate technological advantage, they are worthless if the aircrews cannot perform them. The successful use of tactics to counter technological advantage is directly linked to successful training programs.

Organizational structure must adapt to the unique requirements of armed escort during clandestine penetrations. At present, the "smallest unit employed is the attack helicopter battalion."[4] For short periods of time, the regulation allows attack helicopter companies to fight independently, but this is the exception. Because an attack helicopter company has 10 or 11 helicopters (4 scouts/6 or 7 gunships), this organization is too large for most clandestine operations. Organizational structure would have to be modified to enable elements of platoon size or smaller to train for and conduct independent operations in support of special air operations. In the interests of operational security, a two or three ship flight would likely be the preferred security element employed.

Leadership development should be examined in light of the armed escort requirements of special air operations. Should organizational structure be changed, then lower level

leaders would be forced to shoulder a significantly greater degree of responsibility and leadership while escorting special air missions. Current Army doctrine charges the battalion commander with exercising the leadership necessary to employ a unit effectively in combat. He is the one who usually orchestrates the battle and "fights" the battalion. If the typical organization for escort is a platoon or smaller, the battalion commander would often be left behind. The burden on the battalion commander is to train subordinate commanders to lead the fight.

Recommendations

Developing and evaluating ideas based upon the Concept Based Requirement System (CBRS) should become so common as to be automatic within the Army. CBRS, with its specific considerations, provides an easy template to follow. The methodology is simple enough to be easily understood, yet comprehensive enough to ensure all aspects of a proposal or question are examined. Although it is Army-specific, it has applicability for all the Services.

This Operational Concept should be used to initiate Phase One of the CBRS process, Concept Formulation, which in turn begins Phases Two and Three, Identify Needs and Indentify Solutions. While the demarcation between Phases One, Two, and Three is intentionally fuzzy, completion of the Operational

Concept should enable others to generate the quantitative data necessary to begin in-depth analysis. This analysis can be based upon actual parameters, utilizing the classified data inappropriate for this thesis.

Because the purpose of this thesis was only to generate the Operational Concept; an outline or definition of the problem with minimal consideration of the future steps in the process. There was no recommendation as to a specific airframe or category of aircraft, either helicopter or airplane, as the optimum armed escort. That was left to the combat developers and force structure planners to accomplish during Phases Two and Three of the Concept Based Requirements process. These experts are the ones best able to quantify the threat, hardware requirements, and budgetary realities, in a format acceptable to the aircraft manufacturers.

Areas for Further Study

The electronic combat implications of special air operations armed escort begs another complete thesis. The implications of the evolving threat are mind-boggling. While such a study would be a valuable complement, it is beyond the scope of this paper.

This study only considered the employment phase of special air missions. It would be useful to examine the

protection requirements for special operations helicopters self-deploying to a theater of operations. The deployment phase of an operation may not always occur in a benign environment.

The appropriate mix of air-to-air and air-to-ground weapons was also left for further study. As with all tactical missions, the correct weapons load is situationally dependent. While there may be certain constants, such as an internal air-to-air gun, the other variables are too amorphous for the context of this study.

Lastly, there are some challenging training ranges available to, but not used by SOF aircrews. For many reasons, special operations forces have not made the best possible use of these facilities. A compendium of all available training facilities/ranges, complete with request procedures, possible scenarios and allowable variations, and user evaluations of the training conducted, would be a valuable addition to the overall special operations aviation training program.

[1]Representative Dan Daniel, "The Case for a Sixth Service," Armed Forces Journal International (August 1986), p 70.

[2]FM 44-100, US Army Air Defense Operations (Washington, DC: Hq Department of the Army, 1988), p 2-1.

[3]FM 44-100, p 2-3.

[4]FM 1-112, Attack Helicopter Battalion (Washington, DC: Hq Dept of the Army, 1986), p 3-4.

APPENDIX A

LIST OF ABBREVIATIONS

AAA:	Antiaircraft Artillery
ADA:	Air Defense Artillery
AEW:	Airborne Early Warning
AFFOR:	Air Force Forces (Component Command)
AFM:	Air Force Manual
AFR:	Air Force Regulation
AFSOB:	Air Force Special Operations Base
AFSOC:	Air Force Special Operations Command
AFSOD:	Air Force Special Operations Detachment
An-#:	Soviet designation, Antonov design bureau
ARFOR:	Army Forces (Component Command)
ARSOA:	Army Special Operations Aviation
ARSOF:	Army Special Operations Force
AWACS:	Airborne Warning and Control System
C^2:	Command and Control
C^3:	Command, Control, and Communications
C^3CM:	Command, Control, and Communications Countermeasures
C^3I:	Command, Control, Communications, and Intelligence
CINC:	Commander in Chief
CJCS:	Chairman of the Joint Chiefs of Staff
COIN:	Counterinsurgency
CSAR:	Combat Search and Rescue
CT:	Counterterrorism
DA:	Direct Action
DCA:	Defensive Counterair
DEW:	Directed Enery Weapons
DZ:	Drop Zone
ECM:	Electronic Countermeasures
ESM:	Electronic Warfare Support Measures
EW:	Electronic Warfare
FARP:	Forward Arming and Refuel Point
FEAF:	Far East Air Forces
FEBA:	Forward Edge of Battle Area
FID:	Foreign Internal Defense
FLOT:	Forward Line of Own Troops
FM:	Field Manual
HQ:	Headquarters
HIMAD:	High-to-Medium Altitude Air Defense
IEW:	Intelligence and Electronic Warfare
IFF:	Identification, Friend or Foe

JCS: Joint Chiefs of Staff
JSEAD: Joint Suppression of Enemy Air Defenses
JSOC: Joint Special Operations Command
JSOTF: Joint Special Operations Task Force
JTF: Joint Task Force

LRSU: Long Range Surveillance Unit
LWR: Laser Warning Receiver
LZ: Landing Zone

MAC: Military Airlift Command
MACR: Military Airlift Command Regulation
METT-T: Mission, Enemy, Terrain, Troops, & Time Available
Mil-#: Soviet designation, Mil design bureau
MiG-#: Soviet designation, Mikoyan-Gurevich design bureau
MTT: Mobile Training Team
MWR: Missile Warning Receiver

NATO: North Atlantic Treaty Organization
NAVFOR: Naval Forces (Component Command)
NBC: Nuclear, Biological, and Chemical
NCA: National Command Authority
NSWTG: Naval Special Warfare Task Group

OCA: Offensive Counterair

POL: Petroleum, Oil, and Lubricants

Regt: Regiment
ROE: Rules of Engagement
RWR: Radar Warning Receiver

SA-#: US designation for Soviet SAM
SAM: Surface-to-Air Missile
SAR: Search and Rescue
SEAD: Suppression of Enemy Air Defenses
SFOB: Special Forces Operating Base
SFOD: Special Forces Operations Detachment
SHORAD: Short Range Air Defense
SOA: Special Operaions Aviation (Army)
SOC: Special Operations Command (Subunified Command)
(e.g., SOCEUR in Europe or SOCPAC in Pacific)
SOF: Special Operations Forces
Sqdn: Squadron (USAF)
Su-#: Soviet designation, Sukhoi design bureau

TACAIR: Tactical airpower
TC: Training Circular
TOE: Table(s) of Organization and Equipment
TRADOC: US Army Training and Doctrine Command

USAF:	US Air Force
USASOC:	US Army Special Operations Command
USSOCOM:	US Special Operations Command
UTM:	Universal Transverse Mercator (grid)
UW:	Unconventional Warfare

APPENDIX B

GLOSSARY OF TERMS

Insofar as possible, all definitions were taken from JCS Publication 1, Dictionary of Military and Associated Terms.

Air Assault: Total integration of helicopter assets in their ground or air roles, under the control of the ground or air maneuver commander to engage and destroy enemy forces. (FM 1-100)

Air Maneuver Forces: Aviation maneuver units that operate in the ground environment. These units are integrated into the tactical plan of the ground force commander. (FM 1-100)

Air Transportability: The ability to move an asset via cargo airlift assets, i.e. C-130, C-141, or C-5.

Armed Escort: Those aviation missions flown to protect and support other, more vulnerable, aircraft in order to successfully complete an assigned mission.

Attack Aircraft: Airplanes and helicopters designed for air to ground tactical operations. This usually entails dropping bombs, firing rockets, and shooting a cannon. To the Air Force and the Navy, this means airplanes, to the Army it means helicopters, and to the Marines, it means either helicopters or airplanes.

Airborne Warning and Control System: An airborne command and control platform with an onboard radar able to detect and target other aircraft. NATO, the US, the Soviet Union, and some third world countries possess AWACS aircraft.

Bingo: Term used by pilots to indicate "I have reached minimal fuel for safe return to base."

Bounding Overwatch: A technique of movement used when contact with enemy forces is likely. The lift and the escort elements leapfrog with each other, with the escorts gaining attack and observation positions before the lift elements moved into a new concealed location. (See also Traveling and Traveling Overwatch) (TC 1-201)

Clandestine Operation: An activity conducted in such a manner to assure secrecy or concealment. It differs from covert operations in that emphasis is placed upon concealment of the of the operation rather than concealing the identity of the sponsor.

Combat Air Patrol: An aircraft patrol provided over an objective area, over the force protected, or over the critical area of a combat zone, for the purpose of intercepting and desgtroying hostile aircraft before they reach their target, e.g. ResCAP, Rescue Combat Air Patrol protects the rescue force from ground fire and interception.

Combined Operation: An operation conducted by forces of two or more allied nations acting together for the accomplishment of a single mission.

Concealment: The protection from observation or surveillance. Synonomous with camouflage.

Contour Flight: Low altitude flight, generally conforming to contours of terrain, characterized by varying altitudes and airspeeds, and ground clearances. (FM 90-4, MACR 55-54)

Counterair: Air operations conducted to attain and maintain a desired degree of air superiority by destroying or neutralizing enemy forces. Both air offensive and air defensive actions are involved. (JCS Pub 26)

Counterinsurgency: Those military, paramilitary, political, economic, psychological, and civic actions taken by a government to defeat an insurgency.

Counterterrorism: Offensive measures taken to prevent, deter, and respond to terrorism.

Covert Operation: Operations planned and executed to conceal the identity of or permit plausible denial by the sponsor. They differ from clandestine operations in that emphasis is placed on concealment of identity of the sponsor rather than on concealment of the operation.

Defensive Counterair: Actions taken to minimize the effects of hostile air actions; normally conducted over friendly forces and are generally reactive to initiative of enemy air forces. (JCS Pub 26)

Direct Action: A specified act involving operations of an overt, covert, clandestine, or low visibility nature by special operations forces to seize, destroy, or inflict

damage on a specified target. Can be to capture or recover designated personnel. Missions might include raids, ambushes, providing terminal guidance for precision guided munitions, sniping, or independent sabotage. (FM 31-20)

Doctrine: Fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives. It is authoritative but requires judgement in application.

Electronic Warfare: Military action involving the use of electromagnetic energy to determin, exploit, reduce or prevent hostile use of the electromagnetic spectrum and action which retains friendly use of the spectrum.

Electronic Countermeasures: Actions taken to prevent or reduce an enemy's effective use of the electronmagnetic spectrum. It can include jamming and deception.

Escape Line: A planned route to allow personnel engaged in clandestine activity to depart from an area when possibility of compromise or apprehehsion exists.

Escort: Aircraft assigned to protect other aircraft during a mission. Also written as escort forces if the type of protection is mixed forces.

Exfiltration: Removal of personnel or units from areas under enemy control.

Fighter-helicopter: A new generation of helicopters, whose primary mission is attacking other helicopters. The Soviet Hokum is reported to be a specifically designed fighter helicopter, although many ground attack helicopters are being upgraded to include this capability.

Foreign Internal Defense: Organize, train, advise, and assist host nation military and paramilitary forces to improve the tactical and technical proficiency of these forces so they can defeat an insurgency without direct US involvment. (FM 31-20) Participation by civilian and military agencies in action programs of another government to free and protect its society from subversion, lawlessness, and insurgency. (JCS Pub 1)

Forward Arming and Refuel Point (FARP): A temporary facility, normally located in the main battle area, but can be established to support a single operation, frequently in hostile or denied territory. Once its mission is served, it is quickly dismantled, preferably without leaving signs of its presence.

Forward Edge of the Battle Area: The foremost limits of a series of areas in which ground combat units are deployed, excluding areas in which the covering or screening forces are operating, designated to coordinate fire support.

Forward Line of Own Troops: A line which indicates the most forward positions of friendly forces in any kind of military operation.

Forward Operating Base: A base of operations, usually located in friendly territory or afloat, to extend command, control, or communications support for training and tactical operations. Facilities are usually temporary and may be the loaction of a special operations component headquarters or smaller unit supported by a main operating base.

Ground Clutter: The unintelligible returns generated by radar signals bouncing off the ground. This "noise" cannot be interpreted by the radar set and effectively camoflages targets in close proximity to the ground.

Guerrilla Warfare: Military and paramilitary operations conducted in enemy held or hostile territory by irregular, predominantly indigenous forces.

Infiltration: The movement through or into an area or territory occupied by either friendly or enemy troops. When used in connection with the enemy, it infers that contact is avoided.

Infrared Countermeasures: Systems designed to defeat air and ground launched infrared missiles using passive and active techniques. Passive techniques reduce the natural IR signature of the aircraft. Active measures decoy, jam, or divert the IR missile from the aircraft. (FM 1-100)

Joint operations: An operation conducted by forces of two or more Armed Forces of the United States.

Laser Countermeasures: A warning receiver which displays a warning that a laser designator or range finder is aimed at the aircraft.

Look-Down, Shoot-Down: Fighter airborne radar and missile systems able to detect, acquire, and kill other aircraft below the horizon, supposedly lost in the ground clutter. This is a significant improvement in radar and missile technology, found only in the most modern fighter aircraft.

Low-level Flight: Low altitude flight with constant headings, airspeed, and altitude to facilitate speed and ease of movement while minimizing detection. (FM 90-4, MACR 55-54)

Nap-of-the-Earth: Mode of flight characterized by varying airspeeds and altitudes, and as close to the earth's surface as possible while following the contours of the earth. It is a weaving path oriented to a general axis. Takes advantage of terrain masking. (FM 90-4)

Offensive Counterair: Actions taken to destroy enemy aircraft, missiles, ground support facilities. These are generally at the initiative of the friendly forces and range throughout enemy territory. (JCS Pub 26)

Radar Countermeasures: Systems which provide radar warnings or actively degrade enemy radar systems. Radar detection devices, chaff dispensers, and radar jammers are all effective counters to radar controlled weapons.

Small Arms: Hand held and light, individual or crew served machine guns and rifles.

Special Operations: Operations conducted unilaterally or in conjunction with joint or allied conventional forces, during peacetime, transition to war, and war. Special operations require the capability to conduct missions across the full spectrum of conflict, from the tactical through the strategic level, and include the deep, close, and rear battle zones.

Terrain Flight/Masking: Flying the aircraft to use terrain and vegetation objects to degrade the enemy's ability to visually, optically, or electronically detect or locate the aircraft. It is most effective when an obstacle is placed between the aircraft and the threat. (MACR 55-54, FM 1-100)

Third World: Those countries with underdeveloped but growing economies, often with colonial pasts and low per capita incomes.

Traveling: A movement technique used when contact with the enemy is not likely. It is usually characterized by low-level and terrain flight profiles. This technique provides the least amount of enroute security. (TC 1-201)

Traveling Overwatch: Technique of flight movement when conatct with enemy forces is possible. There is continuous movement of the lift elements. Escorts move at variable speeds and may even pause to take up attack positions at likely ambush points. (See also Bounding Overwatch and Traveling) (TC 1-201)

Unconventional Warfare: Military and paramilitary operations in enemy held, enemy controlled territory, characterized by protracted operations with indigenous forces who are supported by an external source. The intent is to drain the hostile power's morale and and resources, disrupt its administration, and maintain the civilian population's will to resist. Such attacks force the hostile power to divide its reaction and reinforcement capabilities. (FM 31-20)

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